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ABSTRACT

This volume of practical mathematics for the intermediate grades contains three components which can be structured in different combinations according to different student needs. Built around a review of selected objectives in the mathematics basic curriculum, the material is intended to stimulate interest in both mathematics and the professional world. The first section of each component revolves around challenging and fun problems; the second section deals with practical aspects of math in everyday life; and the third component presents math problems similar to those students will encounter in contemporary life. The activities contain narratives, puzzles, games, and other activities of high interest and low readability. Each section is introduced by a statement of learning objectives, the cognitive and affective domains and levels concerned, materials, key words, and guidelines for implementation. Each section also contains an exercise that is applied to home and civic community. The student activities include exercises and evaluations based on the mathematical skill reviewed. The skills and life situations dealt with in this volume are (1) probability problems in connection with communication media, (2) mathematical skills involving weights and measures in connection with health careers, and (3) solving environmental problems through multiplication and division of whole numbers. (AMH)

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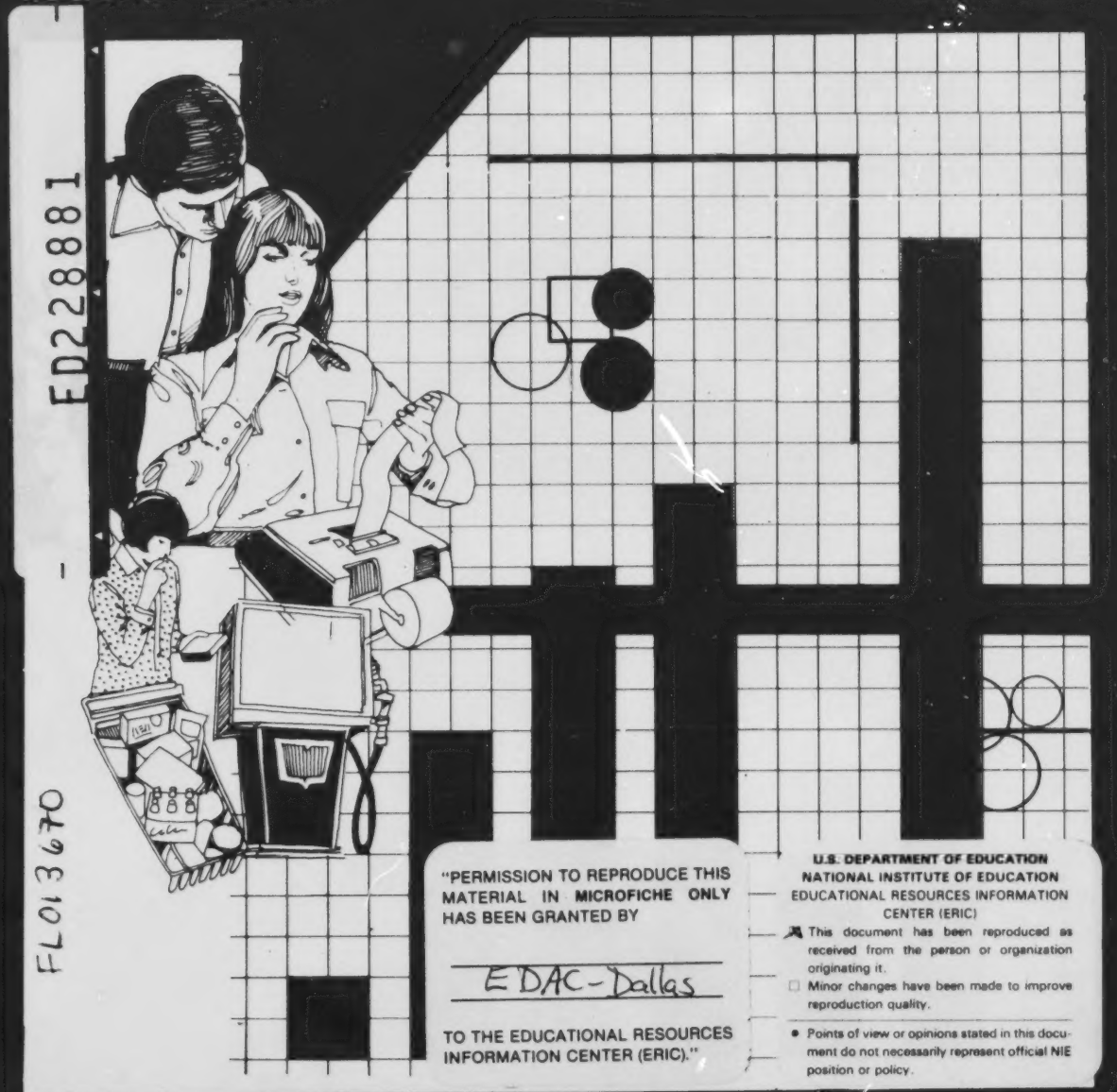
APPLIED BASIC CURRICULUM SERIES

Mathematics:

a practical view

Teacher Edition

Volume III



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Home and Community	153	108
Evaluation	154	109
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INSTRUCTIONAL APPROACH

The activities in Mathematics: A Practical View are intended for the intermediate grades. Each of the three volumes of the series has three components which can be structured in different combinations. In this way, the teacher may choose and use those which best meet students' individual needs. Built around a review of selected objectives in the mathematics basic curriculum, the material stimulates interest in math as well as in the professional world. The first section of the component is designed to motivate students with challenging and fun problems. The second is closely related to objectives dealing with practical aspects of math in everyday life. The third component affords students valuable experience in solving math problems similar to those encountered in the real world. The order in which the three components are presented does not indicate sequence or level of difficulty. The activities contain narratives, puzzles, games, and fun activities which are of high interest and low readability. A detailed procedure section and a Home and Community activity are included in each section. Each activity includes exercises and evaluations based on the math skill reviewed. It is hoped that teachers will find these supplementary materials interesting, innovative, and motivational.

Component 1

Section One

Section Two

Section Three

LET'S HAVE FUN

Introduction

This component is designed to show how math is used in the Recreation and Hospitality Cluster. In the first section, students will learn that an understanding of probability is useful in many sports, games, and other recreational activities. Students will practice finding probabilities with several simple activities. The second section will show students how graphs, tables, pictures, and charts might be used by workers in a city recreation department. The students will understand that much information can be communicated graphically. The third section will focus on the field of sports. Students will determine range, mean, median and mode of sets of data relating to a variety of sports.

GOALS

MOTIVATION: The students will determine the probability of a particular event when given a simple probability sample.

APPLICATION: The students will read and interpret information from tables and graphs, thus gaining the understanding that pictures, charts, graphs, and movies are effective means of communicating.

ORIENTATION: The students will determine the range, mean, median, and/or mode of sets of data in order to solve problems.

LEARNING SECTIONS

SECTION 1: Games of Chance and Skill

SECTION 2: A Day in City Park

SECTION 3: Who won?

COMPONENT I

Section One

Section One
Games of Chance and Skill

Key Words

- recreation
- probability
- dependent
- independent
- odds
- predict

Learning Objective

Given simple probability samples, the students will determine the probability of a particular event, completing the activity according to the criteria of the teacher.

Materials

- copies of the narrative
- one penny for each student
- several wastebaskets and erasers
- small paper bags and scissors

Domains and Levels

Cognitive: Knowledge, Application

Affective: Receiving, Responding

IMPLEMENTATION GUIDELINES

Time: *45 Minutes*

Group Activity

STEP I - State the purpose of the activity:
To see how probabilities might be used in the Recreation and Hospitality Cluster, and to do several experiments relating to probabilities.

STEP II - Read and discuss the introductory section of the activity.

STEP III - Review the key words. If necessary, review these mathematical concepts:

a. Probability = $\frac{\text{number of favorable outcomes}}{\text{total number of possible outcomes}}$

b. The probability of two independent events is the product of the separate probabilities.

c. Making predictions:

Probability X Number of Trials = Expected number of favorable outcomes

Small Group Activity

STEP IV - Group the class into groups of three to five students. Before class, the teacher will have arranged the classroom into several stations, where the small groups can perform each of the four activities. (Example: With 40 students, the teacher may group students into 8 groups of 5 each. There will be 8 stations, with two for each of the 4 activities.)

STEP V - The small groups will rotate among the stations, following the directions given at each one. The materials at each station are as follows:

1. Direction sheets for Activity 1, approximately 20 pennies.
2. Direction sheets for Activity 2, paper bags, scissors.
3. Direction sheets for Activity 3, paper bags, scissors.
4. Direction sheets for Activity 4, several wastebaskets which are placed in a straight line about 15 to 20 feet away from the station, several erasers.

STEP VI - The teacher will need to determine how much time each group can spend at a station, and indicate when and to which station each group should move.

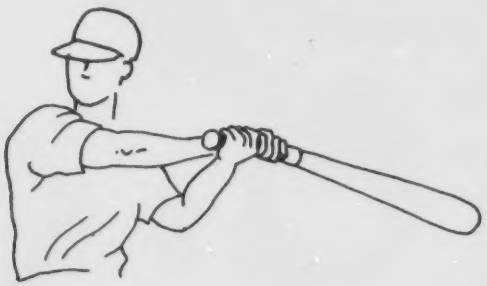
STEP VII - The evaluation is to be completed by students working individually.

STEP VIII - The Home and Community activity will be carried out time permitting.

STUDENT ACTIVITY MATERIAL

GAMES OF CHANCE AND SKILL

"The Jets have a one-in-three chance of winning!"



"The odds are in favor of this movie as the next Emmy Award winner!"

"Step right up, folks. You may be the next winner of the WHEEL OF FORTUNE!"

"That team doesn't have a chance!"

HOME	VISITOR
00	62

"Sorry, folks, but a 90% chance of rain may mean the championship play-offs will be delayed!"

In the field of recreation and sports, statements like these are common. Sometimes, when people speak about "chances" or "probabilities," they are just saying what they hope will happen. Other times, it is important for athletes, fans, moviemakers, or weather forecasters to have real statistics on which to base probabilities.

In the field of recreation and sports, a good understanding of mathematical probabilities is very important. It is not enough for a major league baseball player to be a "good batter." The team manager will want to know just how good he is! So, the manager will figure out the player's batting average. The batting average can then be used to predict how the player may hit in the future. Here is an example.

$$\text{Batting Average} = \frac{\text{Number of hits}}{\text{Number of times at bat}} = \frac{150}{500} = .300$$

You can see that the batting average is figured just like a probability.

$$\text{Probability} = \frac{\text{number of favorable outcomes}}{\text{Total number of possible outcomes}}$$

So, the team manager may predict that the player has a one in three chance of hitting the ball.

You may never be a big league player. But, if you ever visit an amusement park, you may want to figure the probability of winning a game before you play. Suppose the Wheel of Fortune has 100 numbers on it. You choose the number 7 and pay the attendant fifty cents. Will you win? Before you pay, you should know that you have a 1% chance of winning and a 99% chance of losing. Do you still want to pay fifty cents to play?

There are many situations in which people who have jobs in recreation and sports need to figure out probabilities. Today, you will play a few simple games to practice figuring probabilities. Then, whether you have a job in recreation or not, you will know what the T.V. newscaster means when he says, "Grand Runner, with only a one-in-ten chance, won the Green Downs horse race today!"

Activity One

Directions

In this activity, you will see that the probability applies equally to each new event.

1. take one penny.
2. If you toss the coin one time, what is the probability of tossing heads?

   _____

3. If you toss the coin 50 times, how many times would you expect it to land heads up?

   _____

4. Now, toss the coin 50 times. Record the tosses in the tally sheet on the next page.

9

Tally Sheet

Toss	Heads	Tails	Toss	Heads	Tails
1.			26.		
2.			27.		
3.			28.		
4.			29.		
5.			30.		
6.			31.		
7.			32.		
8.			33.		
9.			34.		
10.			35.		
11.			36.		
12.			37.		
13.			38.		
14.			39.		
15.			40.		
16.			41.		
17.			42.		
18.			43.		
19.			44.		
20.			45.		
21.			46.		
22.			47.		
23.			48.		
24.			49.		
25.			50.		

5. How many times did it land heads up?

_____

6. Compare your tosses with those of the other kids in your group.

13

Activity Two

Directions

Independent Events

In this activity, you will experiment with independent events.

1. Cut out the discs on the next page, and fill in Chart A.

	⊕	◎	□	△	Total
Number of Discs					
Probability of Picking (Expressed as Fraction)					
Probability of Picking (Expressed as Percentage)					
Expected Number for 100 Trials					

Chart A

2. Put the discs in a paper bag and shake it up. Draw out one disc and tally your pick on Chart B. Then put it back, shake the bag, and draw again.
3. Continue picking until you have picked a disc one hundred times.

	⊕	◎	□	△
Tally (𝍸) Number of Occurences				
Total				

Chart B

4. Compare Chart B with Chart A. Compare your Chart B with others in your group.

11

15

Activity Three

Directions

Dependent Events

In this activity, you will work with dependent events.

1. Look at the letter squares on the next page. If you cut these up and put them in a bag, what is the probability of picking an M?

   _____ _____

2. If you put your first square back after you have picked, what is the probability of drawing two M's in a row?

   _____

3. Now, suppose you <u>didn't</u> put the first square back. What is the probability of drawing two M's in a row?

   _____ _____

4. Cut up the squares and put them in a bag. There are three pairs of letters in your bag, M - M, A - A, and T - T. Shake up the bag and try two different ways of picking the same two letters in a row.
   a. First, try it by replacing your first pick each time before taking your second pick.
   b. Then, try it by keeping your first pick out before you take your second pick.

   M - M A - A T - T

5. Did anyone in your group draw two in a row of the same letter?
   Which way, a or b, should have a greater probability of drawing a double?

   _____

MATHE-
MATICS

17

13

20

21

Activity Four

Directions

Games of Skill

Sometimes the probability of an event depends on a particular person's skill. In this activity, each person will find a different probability, depending on his or her own skill.

Caution: This activity may be dangerous to your teacher's temper. Please play carefully!

1. Stand 20 feet away from an empty wastebasket. Toss an eraser at the wastebasket, trying to get it in. A friend may stand next to the wastebasket to toss the eraser back to you. Repeat the toss 20 times, keeping track of how many times you toss it in.

	In	Not In
Tally (𝍸)		
Total Number		

2. Now figure out the probability of your tossing the eraser in the basket.

$$\text{Probability} = \frac{\text{Number of Erasers in Basket}}{\text{Total Number of Throws (20)}}$$

3. Convert this fraction to a percentage.

4. Help your friends do this activity. Then compare the probabilities for all the members in your group.

Answer Key to:

Activity One

2. 1/2

3. 25

4, 5, 6. Answers will vary

Activity Two

1.

					Total
Number of Discs	3	1	2	4	10
Probability of Picking (Expressed as Fraction)	3/10	1/10	2/10	4/10	
Probability of Picking (Expressed as Percentage)	30%	10%	20%	40%	
Expected Number for 100 Trials	30	10	20	40	

3, 4. Answers will vary

Activity Three

1. 2/11

2. 4/121

3. 2/110

4. Answers will vary

5. a.

Activity Four

1, 2, 3, 4. answers will vary

HOME and COMMUNITY

Students will arrange a wastebasket-eraser type game at home for family members or for several friends. (They may use a wastebasket, bucket, or similar container, and a rubber ball, wadded up piece of paper, or other soft object to be thrown.) The students will give each player 20 chances to throw the object into the container from a distance of 15 to 20 feet. The students will then figure each player's probability of getting the item in on any given try after that. Another experiment the students might try is to figure the different probabilities for throwing a wadded up piece of paper and a flat piece of paper into the same container from the same distance.

EVALUATION

1. Why might a worker in the field of recreation need to figure out probabilities?

2. A gumball machine has 500 gumballs in it. There are 75 red, 50 white, 100 green, 150 blue, and 125 yellow gumballs. You are going to put a penny in the machine.
   a. What is the probability of getting a yellow one?

   b. Suppose you do get a yellow one. You put in another penny. What is the probability of getting two yellow ones in a row?

Answer Key to Evaluation

1. Probabilities may be used to figure batting averages, odds in a horse race, chance of rain on a ballgame, etc. Any reasonable answer should be accepted.
2. a. 1/4
   b. 31/499

COMPONENT I
Section Two

Section Two
A Day in City Park

Learning Objective

Given a description of the activities of a city recreation department that focus on the idea that pictures, charts, graphs, and movies are an effective means of communicating, the students will read and interpret information from tables and graphs with 80% accuracy.

Key Words

- table
- graph (bar, line, circle)
- recreation
- communicate

Domains and Levels

Cognitive: Knowledge, Application

Affective: Receiving, Valuing

Materials

- one copy of the narrative for each student
- overhead or opaque projector (optional)

IMPLEMENTATION GUIDELINES

Time: *45 Minutes*

Note: The ability to read and interpret information from tables, charts, and graphs is an important skill which will help students in their everyday lives.

STEP I - State the purpose of the activity:
To learn that pictures, charts, and graphs are an effective means of communication, and to see how these might be used by people in the field of recreation.

STEP II - This activity can be used either as a group or an individual activity.

a. For a group activity, the teacher will lead a guided reading and discussion of the narrative. The teacher may wish to show the graphs and charts with an overhead or opaque projector, if available. Students will answer the questions included in the narrative, either orally or in writing.

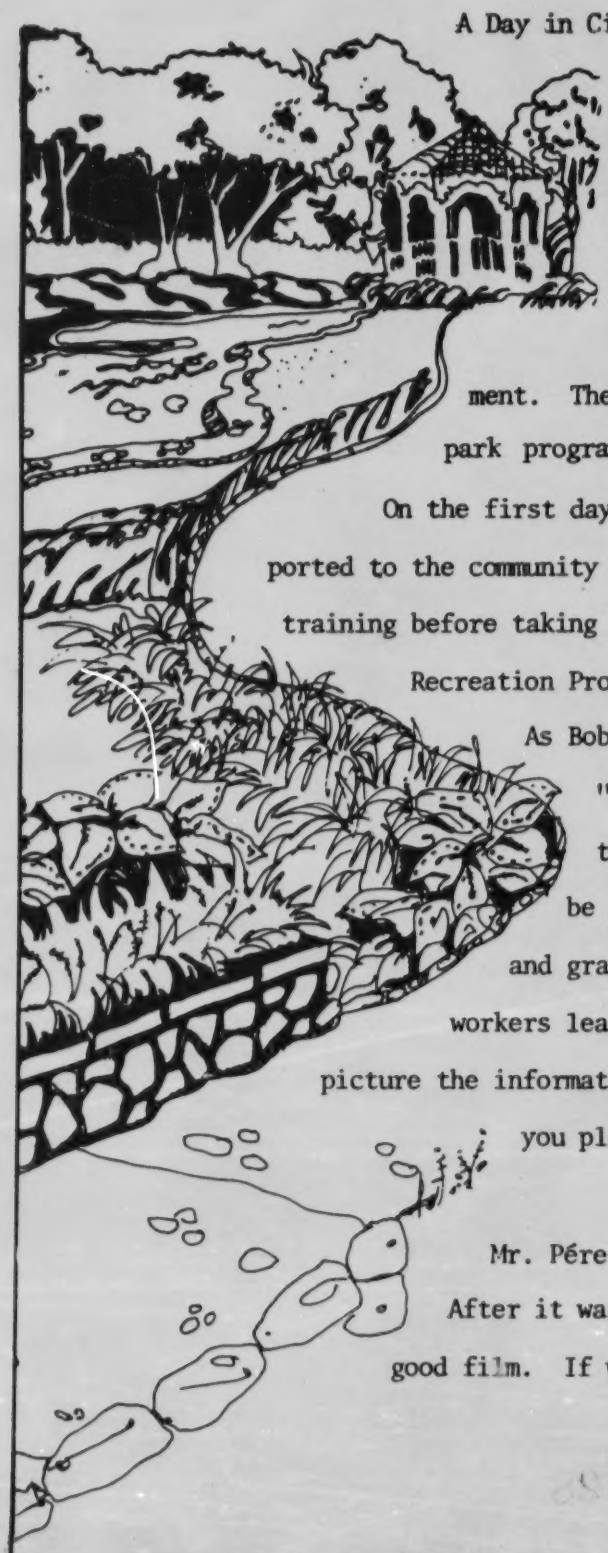
b. Or, students may read the narrative and answer the questions individually.

STEP III - The evaluation is to be completed by students working individually.

STEP IV - The Home and Community section is optional, to be assigned if time permits.

STUDENT ACTIVITY MATERIAL

A Day in City Park



Bob and Karen are seniors in high school. Both Bob and Karen want to have careers in the field of recreation. They have decided to take summer jobs with the city park department. They will learn a lot about working in a park program from their summer jobs.

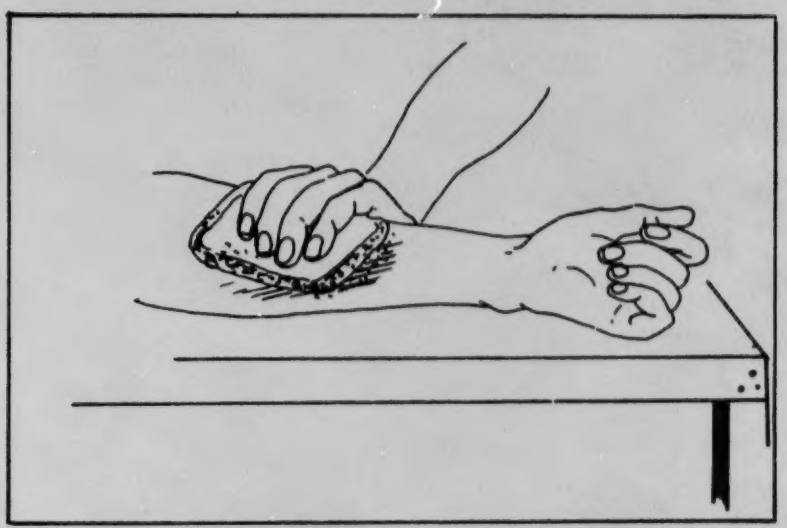
On the first day of summer vacation, Bob and Karen reported to the community center. They needed several days of training before taking their work. Mr. Pérez, Supervisor of Recreation Programs, led the training sessions.

As Bob and Karen sat down, Mr. Pérez began, "Today you will learn many things about the city's recreation program. I will be showing you a movie, pictures, charts and graphs. We have found that our summer workers learn their job faster when they can picture the information we want them to know. Bob, will you please turn out the lights?"

After Bob turned out the lights, Mr. Pérez showed a film about first aid. After it was over Karen said, "Wow! That wa· a good film. If we hadn't seen it, I don't think I

would have been as well prepared to meet a first aid emergency."

"You are right, Karen," said Mr. Pérez. "You will also find pictures like this in each of the recreation center offices to help you remember." Mr. Pérez showed the group this picture and many others.



Control Bleeding
With Direct Pressure

QUESTIONS TO ANSWER

1. What did Mr. Pérez use to help teach the recreation workers about first aid?
2. Why did Mr. Pérez use movies, pictures, charts, and graphs?

"I wonder what we'll learn next," said Bob, as Mr. Pérez began passing out a chart to everyone.

"This chart shows the different facilities which each of our city parks has. Tomorrow you will take a tour of several of them. Let's take a look at the chart now."

Park	Size in Acres	Picnic Area	Golf Course	Tennis Court	Playground	Swimming Pool	Open Play Area	Recreation Center
1. City	147	✓		4		✓		✓
2. Fieldcrest	6			2				
3. Gilmore	10							
4. Meadowland	50	✓		1		✓		✓
5. Moore	10	✓		2		✓		
6. Stuebben	2					✓		
7. University Hill	1							
8. Urban	84					✓		
9. Valley View	103							✓
10. Wayside	16			2				
11. West	11	✓		2		✓		

PARK FACILITIES

QUESTIONS TO ANSWER

3. Which parks have swimming pools?

4. Which is the largest park in town?

5. How many parks have recreation centers?

6. Which parks would you go to if you wanted to play tennis, swim, and then have a picnic, all at the same park?

"You can see that three of our parks have recreation centers. Each of you will be working at one of the parks or at a city pool. Let's look for a minute at what you might be doing if you work at a recreation center."

Mr. Pérez again handed out a chart. "Oh, I see," said Karen. "This chart shows what playground activities are offered at Woodland Park. I'd like to work with this program!"

Time	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
9:00 - 9:30 a.m.	Free Play					
9:30 - 10:30	Group Games	Nature Study	Group Games	Nature Study	Group Games	Staff Meeting
10:30 - 11:15	Drama-tization	Singing Games	Story Acting	Singing	Drama-tization	
11:15 - 12:00	Story-telling	Team Games	Folk-Dancing	Team Games	Folk-Dancing	
12:00 - 1:15 p.m.		Tea Party Sm. Chil.			Picnic	
1:15 - 2:30	Handi-crafts	Handi-crafts	Handi-crafts	Handi-crafts	Handi-crafts	
2:30 - 4:00	League Games	Swimming or other Sp. Ev.	Swimming	Swimming	Child. Special Event	
4:00 5:00	Arts & Crafts	Drama-tics	Arts & Crafts	Arts & Crafts	Contests	
5:00 - 6:00	No Organized Activity					
6:00 - 8:00	League Games	League Games	Group Games	League Games	Special Evening Program	

QUESTIONS TO ANSWER

7. What activity is offered at noon on Fridays?

_____

8. When do the recreation workers meet to discuss the program?

_____

"Sometimes you will need to put some information on a chart yourself," said Mr. Pérez. "This is a report which you will fill out every day. We need to keep good records so we know how to plan our program."

RECREATION DEPARTMENT

Daily Report for _____ Playground

Day _____ Date _____

Attendance Report

	Boys	Girls	Adults	Total
Morning				
Afternoon				
Evening				
Total				

"At the end of a month, you will use the information from your attendance records to make an attendance graph. This, too, will help us plan."

Mr. Pérez showed this graph from June of the year before to Bob, Karen, and the others.

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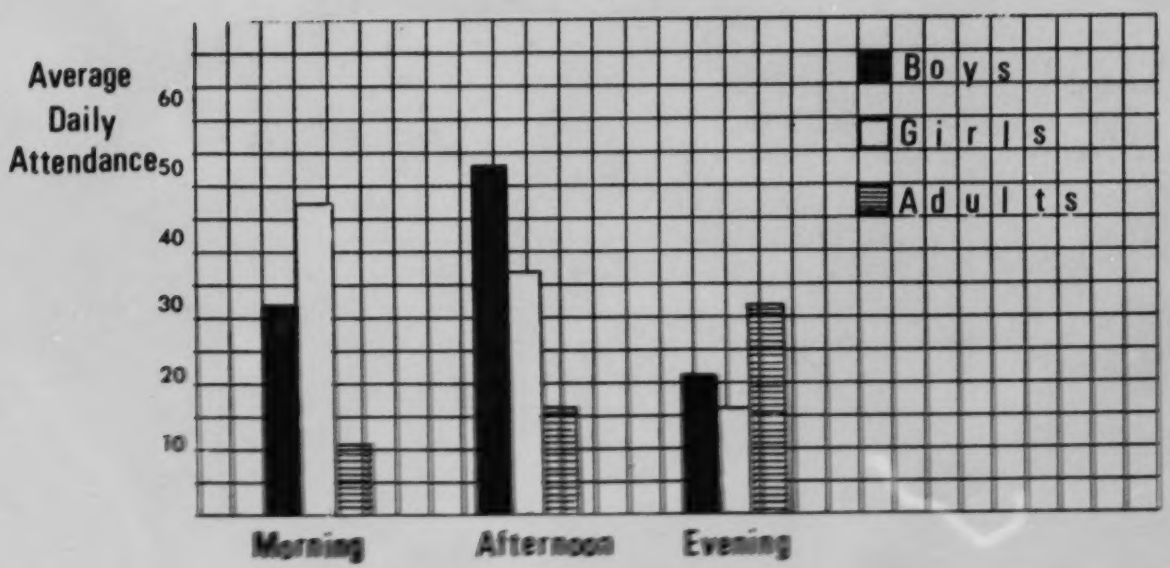


AVERAGE DAILY ATTENDANCE
JUNE

QUESTIONS TO ANSWER

9. Who used the playground the most in the mornings"

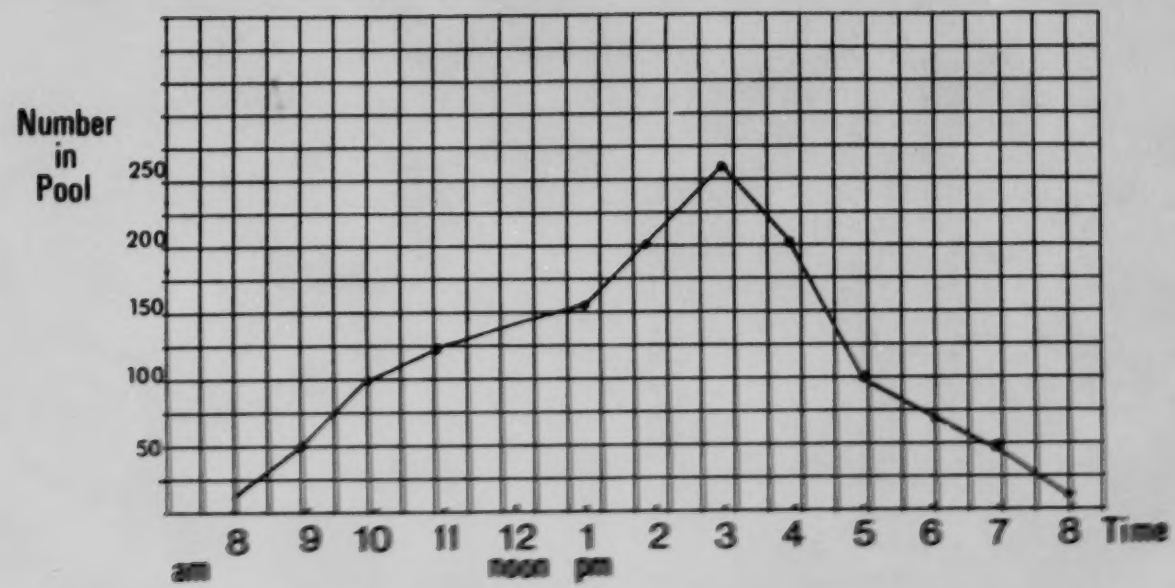
_____

10. When did the most adults use the recreation program?

_____

"This has been very interesting," said Bob, "but I also want to know about the swimming pools. I would like to be a pool lifeguard."

"O.K.," said Mr. Pérez. "The last graph showed when the playground was used most. This next graph will show you when the pool at Woodland Park is used most."



AVERAGE DAILY POOL ATTENDANCE
WOODLAND PARK
JULY

QUESTIONS TO ANSWER

11. When would you swim if you did not want to be in a crowded pool?

_____

12. At what time of day might the recreation department use extra lifeguards?

_____

As Bob and Karen got ready to go home, Karen said, "I have learned a lot today. All of those graphs and charts really helped!"

"Yes, " said Bob, "and tomorrow we'll be ready to spend a day in City Park!"

ANSWER KEY, Narrative

1. Mr. Pérez used a movie, pictures, charts, and graphs.
2. The summer workers could learn their jobs faster when they could picture the information they needed to know.
3. City, Meadowland, Moore, Stuebben, Urban, West
4. City Park
5. Three
6. City, Meadowland, Moore, or West
7. A picnic
8. Saturday at 9:30 a.m.
9. Girls
10. Evening
11. Early morning or evening
12. Middle of afternoon (2:00 - 5:00)

HOME and COMMUNITY

Students will ask 10 friends or relatives to rank eight recreational activities according to what they like to do. Participants will be asked to put their least favorite next to the number 1 and their most favorite next to the number 8. All activities will be thus ranked.

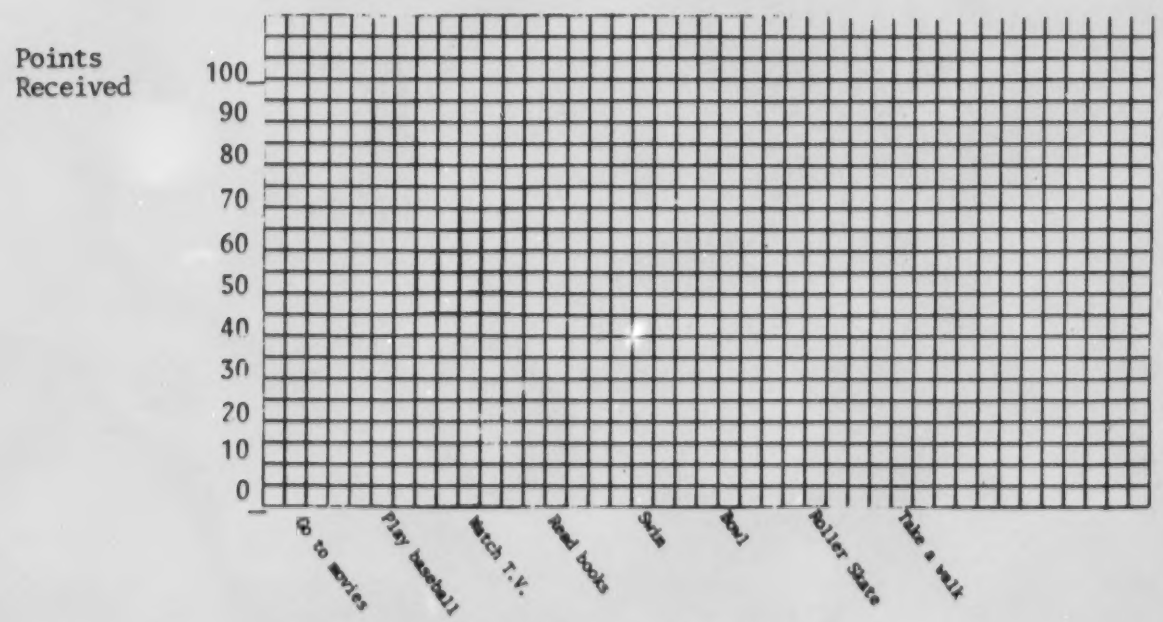
Students will then add up the points given to each activity by the 10 participants. They will make a bar graph using this information. Students may use the form on the next page to complete this activity.

HOME and COMMUNITY

Worksheet

Here are some things you might like to do in your spare time. Please rank them from your least favorite to your most favorite.

Go to movies	Least Favorite	1.
Play baseball		2.
Watch T.V.		3.
Read books		4.
Swim		5.
Bowl		6.
Roller Skate		7.
Take a walk	Most Favorite	8.



WHAT MY FRIENDS (RELATIVES) LIKE TO DO

EVALUATION

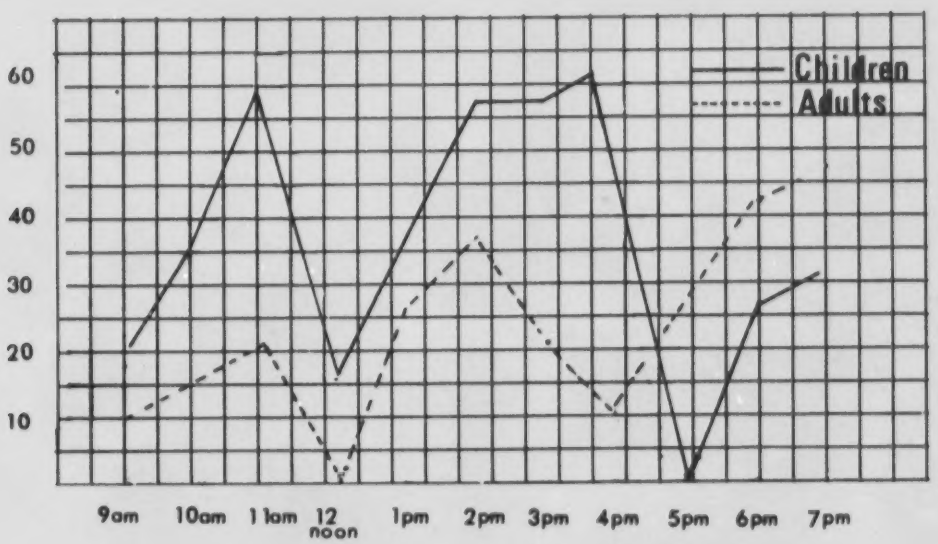
Evaluation

1. Why did Mr. Pérez use charts, graphs, pictures, and movies to train summer recreational workers?

_____

_____

2. Look at this graph.



a. When do the most children use the recreation program?

_____

b. When do the most adults use the recreation program?

_____

c. What is the average daily attendance of children at 10:00 a.m.?

_____

EVALUATION

Answer Key to Evaluation

1. The summer workers could learn their jobs better.
2. a. at 11:00 a.m. and at 4:00 p.m.

   b. at 7:00 p.m.

   c. 35 children

COMPONENT I
Section Three

Section Three
Who Won?

Learning Objective

Given sets of data taken from several kinds of sports, the students will determine the range, mean, median, and/or mode with 75% accuracy.

Key Words

- mean
- median
- mode
- range

Domains and Levels

Cognitive : Knowledge, Application

Affective : Receiving

Materials

- copies of the narrative

IMPLEMENTATION GUIDELINES

Time: *45 Minutes*

STEP I - State the purpose of the activity:
To practice finding mean, median, mode and range in a set of problems which relate to the sports world.

STEP II - Read and discuss the Introduction. Review the key words, and make sure all students know how to find the mean, median, mode, and range.

STEP III - Students will work individually to solve the problems in this activity. The teacher will be available to answer questions.

STEP IV - This evaluation is to be completed by students working individually.

STEP V - The Home and Community section is optional, to be completed as time permits.

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STUDENT ACTIVITY MATERIAL

Introduction

Do you ever think about mathematics when you're at the ball game? Your immediate answer is probably "No, never!" But think about it again. The field of sports is filled with numbers. Many games depend on keeping score. Could you keep score at the football game without numbers? Many athletic events depend on records. Could you break the record for the 100-yard dash if you didn't know what the record was?

We really wouldn't enjoy sports without numbers, would we? Everyone wants to know who won, and this is determined by numbers. Of course, we are also interested in other numbers we find in sports. We like to know average hitting records. We like to know how tall the basketball players are. And we even like to know how many people attended the game last night.

Today you will be working with sets of numbers which come from the field of sports*. You will use this data to figure out the mean, the median, the mode, and the range of the data. Then, at the end of this lesson, the answer to the question "Who won?" should be YOU!

---

*the data in problems 1, 2, 4, 5, and 7 come from the following:

Guinness Book of Women's Sports Records, Norris McWhirter, Sterling Publishing Co., Inc., New York, 1979.

Sports and Games Almanac, 1979, ed. Norman L. Smith, Facts on File, Inc., 1979.

The Year They Won the Most Valuable Player Award, Milton J. Shapiro, Julian Messner, New York, 1966.

Problems

1. Jackie Robinson was the first Black man to play in organized professional baseball. This table shows his batting average from 1946 to 1956.

1946	.349	1952	.308
1947	.297	1953	.329
1948	.296	1954	.311
1949	.342	1955	.256
1950	.328	1956	.275
1951	.338		

   a. What was Jackie Robinson's mean batting average?

   _____

   b. What was the range of Jackie Robinson's batting average for the eleven years?

   _____

2. This table shows the world track records set by women in the 100 meter race. As you can see, the women are always working to break the previous record.

Year	Time in Seconds	Name	Country
1921	12.8	Marie Kiessling	Germany
1926	12.6	Gundel Wittmann	Germany
1926	12.4	Gundel Wittmann	Germany
1927	12.4	Eileen Edwards	Great Britain
1927	12.2	Elizabeth Robinson	United States
1927	12.1	Hilde Gladitsch	Germany
1928	12.0	Elizabeth Robinson	United States
1932	11.9	Tollien Schuurman	Netherlands
1933	11.8	Stella Walasiewicz	Poland
1934	11.7	Stella Walasiewicz	Poland
1935	11.6	Helen Stephens	United States
1936	11.5	Helen Stephens	United States
1952	11.4	Marjorie Jackson	Australia
1955	11.3	Shirley DeLa Hunty	Australia
1961	11.2	Wilma Rudolph	United States
1965	11.1	Irena Kirszenstein	Poland
1968	11.0	Wyomia Tyus	United States
1973	10.9	Renata Stecher	East Germany
1973	10.8	Renata Stecher	East Germany

a. What is the mean time, in seconds, for women running the 100 meter race from 1921 to 1973?

_____

b. What is the median time?

_____

c. What is the range, in seconds?

_____

3. Last year, twenty-one boys came out for the football team at Jefferson High School. This table shows how much the players weighed.

Name	Weight (lbs)	Name	Weight (lbs)
Jones	130	Fields	156
Kirby	132	Wocynski	158
Casals	135	Martin	160
Andrews	142	Gómez	160
Berger	142	Lamb	162
Jiménez	146	Waterman	170
Smith	148	Edmonds	171
Walters	150	Norwood	185
Chavez	150	Derr	188
Jarrett	150	Kelly	210
Cole	155		

a. What is the median weight?

b. What is the mode?

c. What is the mean weight?

d. What is the range of weight?

4. When Mickey Mantle played for the New York Yankees baseball team, he won the Most Valuable Player Award three times. This table shows his batting average for the years 1951 to 1964.

1951	.200	1958	.250
1952	.345	1960	.400
1953	.208	1961	.167
1955	.200	1962	.120
1956	.250	1963	.133
1957	.263	1964	.333

a. What is the range of Mickey Mantle's batting average?

_____

b. What is Mickey Mantle's mean batting average?

_____

5. The attendance at Texas Ranger baseball games has changed from year to year as this table shows.

Year	Attendance
1972	662,974
1973	686,150
1974	1,193,902
1975	1,127,924
1976	1,164,982

YEARLY ATTENDANCE

a. What was the mean attendance for the five years listed?

_____

b. What was the range of attendance?

_____

6. The girls' basketball team at Willard High has won the district championship three years in a row. This table shows how tall the players were last year.

Player	Height
Connor	5'5"
Baca	5'6"
Meyers	5'8"
Campbell	5'8"
Streeter	5'9"
George	5'10"
Ivory	5'10"
Spiegel	5'10"
McNally	5'11"
O'Toole	6'
Washington	6'1"

a. What is the range of heights?

_____

b. What is the mean height?

_____

c. What is the median height?

_____

d. What is the mode?

_____

7. This table shows the top ten scorers in professional basketball in the year 1979.

Name	Team	Average Points/Game
Gervin	San Antonio	27.2
Thompson	Denver	27.2
McAdoo	New York	26.5
Abdul-Jabbar	Los Angeles	25.8
Murphy	Houston	25.6
Westphal	Phoenix	25.2
R. Smith	Buffalo	24.6
Lanier	Detroit	24.5
W. Davis	Phoenix	24.2
King	New Jersey	24.2

a. What is the range of points scored?

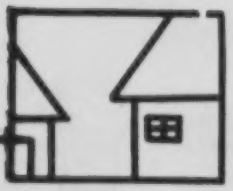
_____

b. What is the mean number of points scored per game for all ten players?

_____

Answer Key to Narrative

1. a. .312
   b. .093
2. a. 11.7 seconds
   b. 11.7 seconds
   c. 2 seconds
3. a. 155 lbs
   b. 150 lbs
   c. 157 lbs
   d. 80 lbs
4. a. .280
   b. .239
5. a. 967,186
   b. 530,928
6. a. 8"
   b. 5'9"
   c. 5'10"
   d. 5'10"
7. a. 3 points
   b. 25.5 points



HOME and COMMUNITY

Keep a record of the scores made by your favorite baseball, football, soccer, basketball, or other team. This can be your school team or a professional team. After eight games, find the range and mean of scores. Also try to figure out the median and the mode, if you can.

EVALUATION

Evaluation

1. Do you think you would enjoy sports if we had no numbers? Why or why not?

_____

_____

2. A team has played seven games. The scores for the games are as follows.

Game	Scores
1.	46
2.	68
3.	54
4.	32
5.	54
6.	72
7.	47

a. What is the range of scores?

_____

b. What is the mean score?

_____

c. What is the median score?

_____

d. What is the mode?

_____

ANSWER KEY

1. Answers may vary.

2. a. 40 points

   b. 53 points

   c. 54 points

54 d. 54 points

Component 2

Section One

Section Two

Section Three

HERE'S TO YOUR HEALTH

Introduction

In this component, students will learn how math is amplied in a variety of jobs found in the Health Career Cluster. The purpose of the first section is to interest students in the field of health, by presenting them with a variety of interesting facts about the human body. The students will use some of these facts to solve problems involving numbers expressed in decimal form. The second section has two emphases: to teach students that they must consider worker qualifications when making a career choice, and to give students practice in identifying the metric units appropriate to a variety of problems. With the third section, the students will practice using measures of weight, length, volume, temperature, time, and money to estimate and solve problems. Each problem is set in the context of a health-related career.

GOALS

MOTIVATION: The students will add, subtract, multiply, and divide numbers in decimal form, in order to solve problems.

LIFE SKILLS: The students will identify the metric unit which is appropriate to particular problems, and they will understand that worker qualifications should be considered in making a career choice.

MATH SKILLS: The students will use units of weight, volume, length, temperature, time, and money to estimate and determine measures, and to solve problems.

LEARNING SECTIONS

SECTION 1: The Incredible Machine

SECTION 2: Mrs. Pauling Pediatric Nurse

SECTION 3: When Accuracy Counts

COMPONENT II

Section One

Section One
The Incredible Machine

Learning Objective

Given a set of facts about the human body, the students will solve problems using numbers expressed in decimal form, completing the activity with 75% accuracy.

Key Words

- health
- circulatory system
- incredible
- decimal

Domains and Levels

Cognitive: Knowledge, Application

Affective: Valuing

Materials

- one copy of the narrative for each student

IMPLEMENTATION GUIDELINES

Time: 45 minutes

STEP I - State the purpose of the activity:
To see what a fascinating "machine" the human body is and to practice working with decimals.

STEP II - This activity can be used as a large group, small group or individual activity.

a. For a large group activity, the teacher will lead a guided reading and discussion of the narrative. Students should be encouraged to "picture" how big or small some of the measurements listed really are. For example, the students may measure 22 feet on the floor to see how long the small intestine is. The teacher should also make it clear to students that the numbers given are, for the most part, averages or approximations. After the narrative is read, students can work the problems individually.

b. The teacher may break the class into groups of four to six students for reading and discussion of "The Incredible Machine." Again, students may work the problems on their own.

c. Or, the entire activity can be read and completed by students working individually.

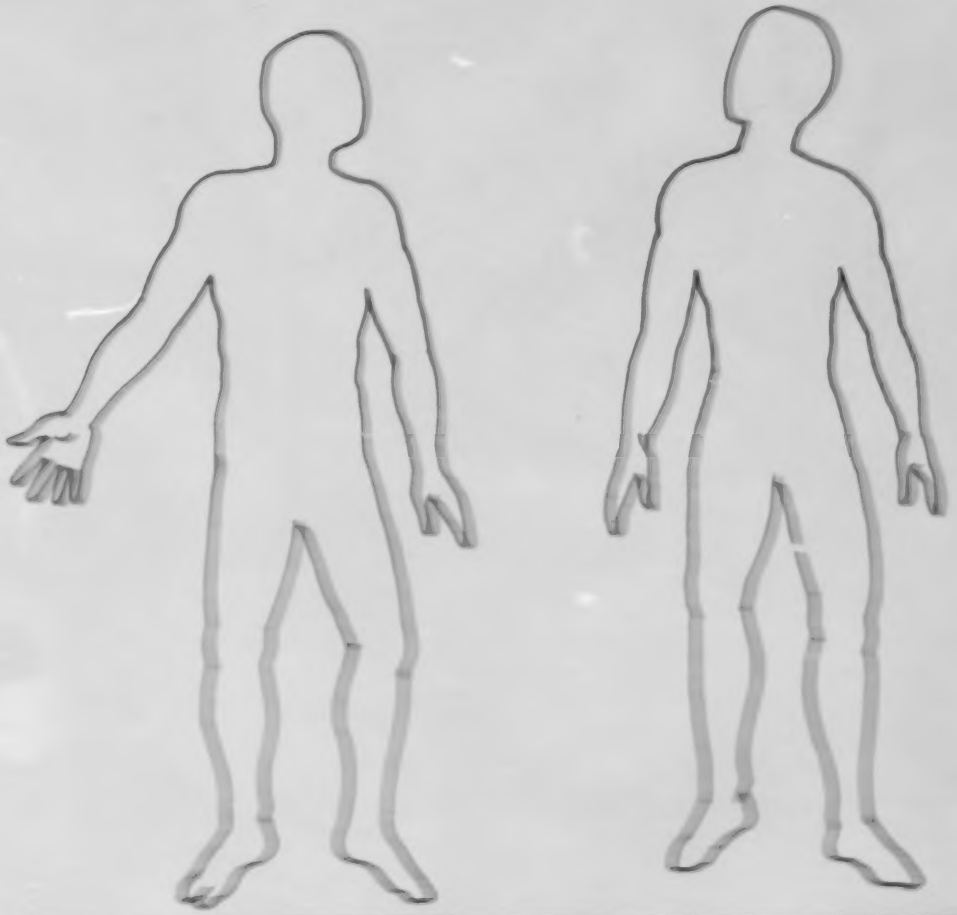
Evaluation

STEP III - The evaluation is to be completed by students working individually.

STEP IV - The Home and Community activity is optional, to be completed if time permits.

STUDENT ACTIVITY MATERIAL

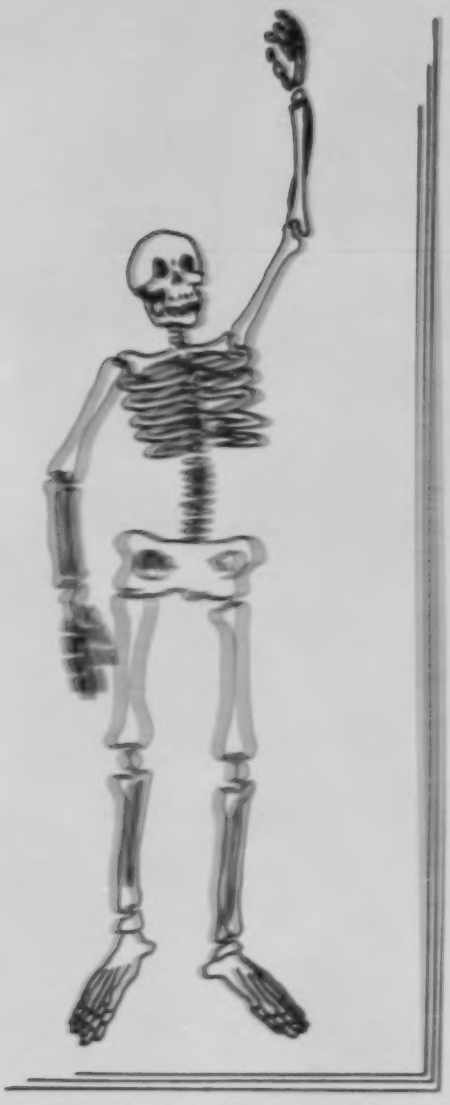
THE INCREDIBLE MACHINE



The human body is truly an incredible machine! All wrapped up in one package is a machine which can think, run, make things, talk, laugh, swim, create . . . and do just about anything you can imagine.

Many people choose to have careers in the field of health just because the the human body is so fascinating. People in the health field make sure that this incredible machine is working just right. And, when the machine breaks down, they try to fix it!

On the next few pages, you will read some interesting things about the human body. Many of these facts include numbers, because oftentimes numbers can give us a better understanding of just how incredible the human body is.



MUSCLES AND BONES

Did you know . . .?

There are 639 muscles and 206 bones in the human body.

The smallest muscle is the stapedus (about .04 inches long), and the smallest bone is the stapes (about 1/8 inch long). Both are found in the middle ear!
H = 1/8 inch

There are 22 bones in the head and 26 bones in the foot.

We use 300 muscles when we walk. (Not all of them are in the legs!)

About 40% of a man's weight and 30% of a woman's weight is made of muscle.

Bone, not including the marrow, is about 25% water.

WRAPPING THE PACKAGE

Would you believe . . . ?

The skin is an organ of the body just like the heart and lungs. The skin's job is to give protection, to feel, to hold moisture in the body, and to be flexible.

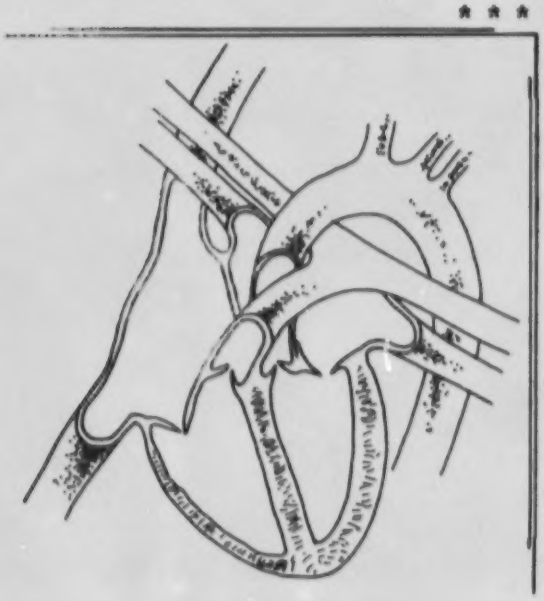
The skin on an average adult covers about 3,100 square inches.

Hair, fingernails, and toenails are special types of skin.

Your hair grows an average of one inch every 10 weeks.

It takes from 117 to 138 days for your fingernails to grow from the cuticle to cutting length.

* * * * * * * * * * * * *



THE MARVELOUS PUMP

The circulatory system is composed of the heart and all the blood vessels -- veins, arteries, and capillaries. You may be surprised to learn . . . !

If all the body's blood vessels were stretched out end to end, they would go on for 10,000 miles! (The earth is 24,897.59 miles around at the equator.)

The heart pumps about 3,600 gallons of blood in an adult male in 24 hours.

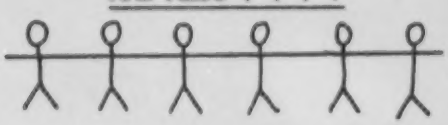
The work that the heart does each minute is the same amount of work done when you lift a 70 pound weight a foot off the ground.

Men have about 5.5 liters of blood and women have about 3.25 liters.

When the left ventricle, or chamber, of the heart pushes blood into the aorta, the blood is traveling at .9 miles an hour.

The marvelous pump which does all this work, the human heart, only weights about 10 oz. in an adult male and 8 oz. in the female. (Two sticks of butter weigh 8 oz!)

AND ALSO . . . !



The average human body consists of 50,000,000,000,000 (50 trillion) cells!

The human eye contains some 130,000,000 light sensitive cells!

The small intestine, if stretched out, would be from 22 to 25 feet long!

The adult human body contains about 50 quarts of water!

After the age of 35 or 40, we shrink about 1/2 inch in height every ten years!

The lungs are like a sponge with many thin-walled air sacs. The lungs can take in over 4,000 cubic centimeters of air in one breath!

In the first year of life, the average human baby more than triples in weight! (How much would you weigh on this date next year if you tripled your weight?)

TEST YOURSELF

Here are a few math problems. You will find out a little more about the incredible machine when you solve them.

1. The smallest muscle in the body is .04 inches long, and the smallest bone is .125 inches long. How much longer is the bone than the muscle?

2. A 40-year-old man is 5' 10" tall. If he shrinks .5 inches every 10 years, how tall will he be when he is 75 years old?

3. If human hair grows .3 mm a day, how long will it grow in a 31-day month?

   _____ mm

   _____ cm (There are 10 mm in 1 cm.)

4. We can figure out how tall a person is from the length of the femur, or thigh bone, by using this formula.

Male height =	Female height =
1.880 X(femur) + 32.010 inches	1.945 X(femur) + 28.679 inches

   a. How tall is a man with a femur 18.3 inches long?

b. How tall is a woman with a femur 18.3 inches long?

5. An average baby boy is 50.8 cm long at birth and 76.3 cm long at the age of one year.

   a. How many centimeters has this baby grown in one year?

   b. The baby grows an average of how many centimeters a month in the first year life?

ANSWER KEY

1. .085 inch

2. 5' 8.25"

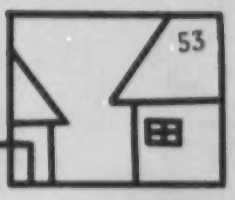
3. 9.3 mm
   .93 cm

4. a. 66.4 inches (or 5' 5")

   b. 64.3 inches (or 5' 3")

5. a. 25.5 cm

   b. 2.125 cm



HOME and COMMUNITY

At home, students will make a list of as many health-related careers as they can think of or find. The students can ask friends or relatives to help in compiling the list, and they can use the public or school libraries. After completing the list, the students will put an X next to the jobs they think would require math skills. The students will be asked to bring their lists back to school, so a master list of health jobs can be compiled.

EVALUATION

1. Write down one fact about the human body which you found to be especially interesting. _____

   _____

   _____

   _____

2. If an adult male has 5.5 liters of blood, and an adult female has 3.25 liters, how much more does the male have? _____

3. A boy weighs 128.5 pounds. If his body is 60% water, how many pounds of water does his body contain?

Answer Key

1. Answers will vary
2. 2.25 liters
3. 77.1 pounds

COMPONENT II
Section Two

Section Two
Mrs. Pauling, Pediatric Nurse

Key Words

- pediatric nurse
- pediatrician
- patient
- metric units
- worker

Learning Objective

Given a description of the daily activities of a pediatric nurse, the students will describe the worker qualifications needed for this job, and they will identify the metric unit to be used in a variety of nursing situations. The activity will be completed with 80% accuracy.

Materials

- one copy of the narrative for each student

Domains and Levels

Cognitive : Knowledge, Application

Affective : Receiving, Valuing

IMPLEMENTATION GUIDELINES

Time: 45 *Minutes*

Note: The understanding that there are different worker qualifications needed for different jobs will help students in making a wise career choice as they approach adulthood.

STEP I - State the purpose of the activity:
To learn about the worker qualifications appropriate to the field of nursing and to practice working with the metric system of measurement.

STEP II - Discuss the key words.

STEP III - This activity can be used either as a group or individual lesson.

a. For a group activity, the teacher will lead a guided reading and discussion of the narrative. Students will answer the questions either orally or in writing. Students may look back at the narrative, if necessary, to answer the questions.

b. Or, students may read the narrative and answer the questions individually.

Evaluation

STEP IV - The evaluation is to be completed by students working individually. The students should not look back at the narrative to complete this.

STEP V - The Home and Community section is optional.

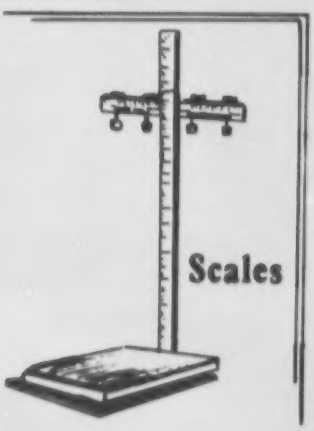
STUDENT ACTIVITY MATERIAL

MRS. PAULING, PEDIATRIC NURSE

Mrs. Pauling is a pediatric nurse. She works in a clinic with four pediatricians, or children's doctors. She chose to be a nurse for several reasons. For one thing, she has always liked working with people, and she feels good about being able to help others. Another reason is that Mrs. Pauling enjoyed learning about the physical and social sciences when she was in school. She finds that she still enjoys learning about science, especially as it applies to health. Finally, Mrs. Pauling chose to be a nurse because she likes being part of a team.

On the job, Mrs. Pauling is always busy. Even when she is rushed, she needs to be cheerful and patient. Mrs. Pauling also needs to be accurate. She does a lot of measuring, using the metric system, and the doctors must rely on her measurements.

Let's spend a little time with Mrs. Pauling to see just what a pediatric nurse does.



9:00 a. m.

Mrs. Pauling is getting four-year old Johnny ready for a checkup with the doctor. First she measures Johnny's height and weight. She gives Johnny a big smile.

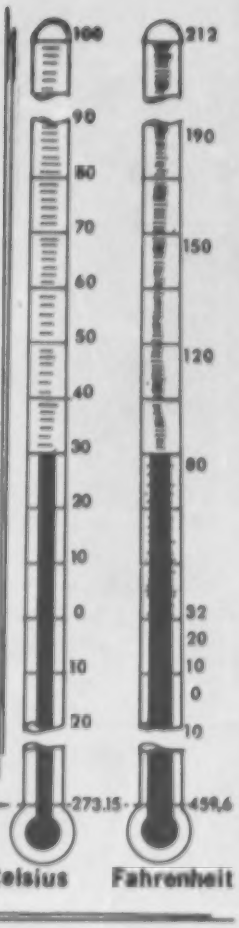
"My, you've grown this year. You are 105 centimeters tall and weigh 17 kilograms!"

"Is that a lot?" asks Johnny.

"It's just right," answers Mrs. Pauling.

9:30 a. m.

After Johnny's checkup, Mrs. Pauling asks six-year-old Joanne and her mother to come in. Joanne has been sick for several days with a sore throat and cough. First Mrs. Pauling takes Joanne's temperature. Then she writes it down on Joanne's chart -- 39°C -- so the doctor will be able to see it when she comes in.



After the doctor has examined Joanne, she tells Mrs. Pauling that Joanne will need an injection, or shot. As soon as Joanne hears the word "shot," she begins to cry. Mrs. Pauling patiently explains to Joanne why she needs a shot, and soon she stops crying. Mrs. Pauling swiftly injects .5 cc of medication into Joanne's arm before she can blink her eyes. (One cc is equal to one cubic centimeter.)

"There, all done! And here's a pretty balloon for you!" says Mrs. Pauling.

The doctor has left a prescription for Joanne's mother to have filled. Mrs. Pauling explains that Joanne will need to take 5 ml, which is the same as 1 teaspoon, of cough syrup four times a day.

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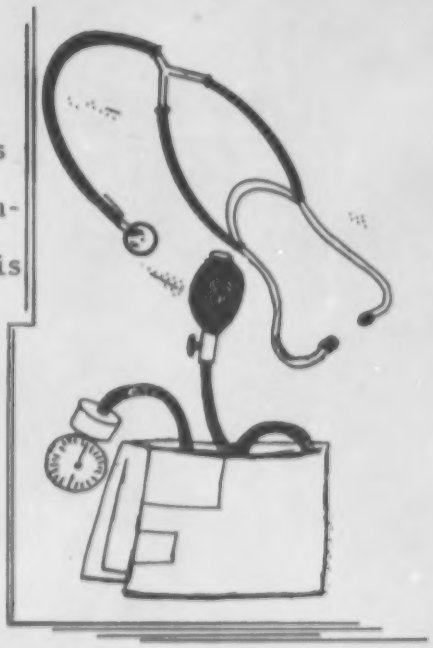
It is very important for Mrs. Pauling to make sure that the doctor's orders are understood and followed.

10:00 a. m.

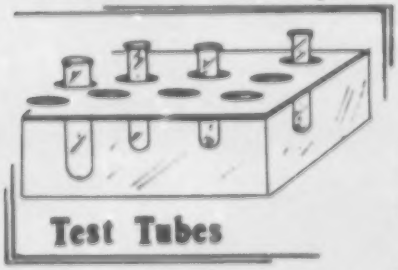


The next patient Mrs. Pauling greets is Bill. Bill is sixteen years old. He has felt tired and run-down lately. First, Mrs. Pauling measures Bill and takes his temperature. Then she takes his blood pressure.

"I've always wondered how blood pressure is measured," says Bill. "Can you tell me?"

"Of course," replies Mrs. Pauling. She explains that Bill's blood pressure is 120/80. This means that at the peak of each heart beat, there is enough pressure to push a column of mercury 120 millimeters high in the glass tube of the instrument used. Then, just before the next heart beat, the lowest pressure is still enough to push the mercury 80 millimeters high.

Just as Mrs. Pauling finishes explaining, the doctor comes in. He examines Bill and then tells Mrs. Pauling that Bill needs to have some tests taken. Mrs. Pauling can see that Bill is a little worried about the tests. So, she tells him what to expect.



"You will have a blood sample taken from your arm. They will take 5 milliliters of blood. Your body has at least 5 liters of blood, so you can see they will only be taking about 1/1000th of your total blood volume."

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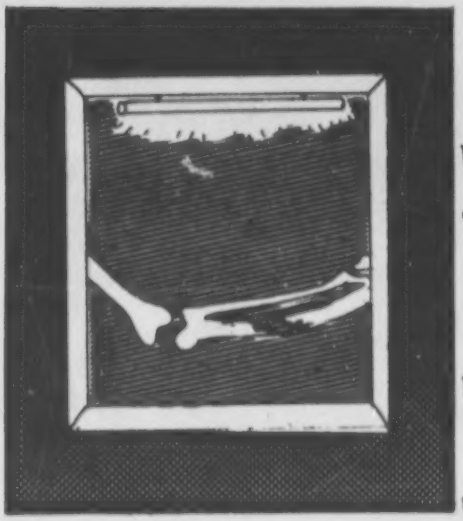
"Thank goodness!" says Bill, on his way to the lab.



10:30 a. m.

The next patient is ten-year-old Monica. When Monica and her father come in, Mrs. Pauling can see that Monica has been crying.

"What's wrong, Monica?" she asks.

"I fell off my bike and I think my arm is broken!"

Mrs. Pauling makes Monica comfortable until the doctor comes in. He tells her to go along with Monica to the X-ray room.

It turns out that Monica does have a broken arm, so the doctor puts it in a cast. Mrs. Pauling explains to Monica's father that Monica may have some pain. She tells him that it will be all right for Monica to take one 320 milligram tablet of aspirin six times a day. She is also careful to tell Monica's father that it would be dangerous for Monica to take too much aspirin. "Please call the doctor's office if Monica has too much pain," says Mrs. Pauling.

11:00 a. m.

It is not yet lunch time, and Mrs. Pauling has many more patients to see today. It is a good thing that Mrs Pauling has lots of energy and is in good health. She will have a busy day today. It is also good that she really
80 enjoys her job as a pediatric nurse.

Questions to Answer

1. What are some of the qualifications you think a person needs to be a good nurse?

_____

_____

_____

2. What might happen if a nurse is not accurate in taking measurements?

_____

_____

_____

3. Here are the most commonly used units in the metric system, and their abbreviations.

meter	m	milligram	mg
millimeter	mm	kilogram	kg
centimeter	cm	liter	l
kilometer	km	milliliter	ml
gram	g		

Which unit would a nurse use to measure the following?

a. a child's height? _____

b. a child's weight? _____

c. a blood sample? _____

d. medicine in pill form? _____

e. medicine in liquid form? _____

f. blood pressure? _____

g. the distance the nurse travels to work? _____

ANSWER KEY

1. Any of the following qualifications might be mentioned:

   interest in science, accuracy, reliability, interest in working with people, ability to work as part of a team, patience, good health, pleasant personality, ability to take orders

2. Any reasonable answer should be accepted.

3. a. centimeter

   b. kilogram

   c. milliliter

   d. milligram

   e. milliliter

   f. millimeter

   g. kilometer

HOME and COMMUNITY

The students will ask at least five relatives, friends, or neighbors the following questions:

1. What is your job?
2. What qualifications are needed for your job?
3. Do you ever use the metric system in doing your job? If so, when?

EVALUATION

In each sentence, fill in the correct unit. (m, mm, cm, km, g, mg, kg, l, ml)

1. Five-year-old Tommy weighs 21 _____.
2. A newborn baby is 52 _____ long.
3. Mrs. Pauling travels 6 _____to work each day.
4. Each pill weighs 250 _____.
5. Would you like to have a job in the field of health?

   What qualifications, if any, do you have that would make you a good health worker? _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____

   _____

ANSWER KEY

1. kg
2. cm
3. km
4. mg
5. Any reasonable answer should be accepted.

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COMPONENT II

Section Three

Section Three
When Accuracy Counts

Key Words

- health
- prescription
- measure
- estimate
- exact
- approximate

Learning Objective

Given descriptions of several workers in the Health Cluster, the students will use units of weight, volume, length, time, temperature and money to estimate and determine measures and to solve problems with 80% accuracy.

Materials

- one copy of the narrative for each student.

Domains and Levels

Cognitive: Knowledge, Application

Affective: Receiving, Responding

IMPLEMENTATION GUIDELINES

Time: *45 Minutes*

STEP I - State the purpose of the activity:
To learn how several workers in the field of health use units of measurement and to practice using units of measurement to estimate and solve problems.

STEP II - Read and discuss the Introduction. Review the key words, if necessary.

STEP III - Students will work individually to solve the problems in this component. The teacher will be available to answer questions.

Evaluation

STEP IV - The evaluation is to be completed by students working individually.

STEP V - The Home and Community section is optional, to be completed if time permits.

STUDENT ACTIVITY MATERIAL

Introduction

In the health care field, measuring is an everyday activity. Nurses measure temperature, height, and weight. Laboratory technicians measure the volume of blood samples. Respiratory therapists measure the amount of air which goes in and comes out of a patient.

Usually, the metric system of measurement is used by workers in the field of health. However, a doctor might tell a patient how much he weighs in pounds, give a prescription in terms of teaspoons, or report a temperature in Fahrenheit degrees. So, there are situations when both customary and metric measures are used.

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In many cases the measurements made by the health worker must be exact. In fact, the patient's life may depend on these exact measurements. In other cases the health worker may be able to estimate a measurement. For example, a nurse may have taken a person's temperature and found it to be 104.2°. She gives him his medication, and an hour later the person's temperature has dropped to 101.3°. She may report to the doctor that the patient's temperature has dropped three degrees in the hour following medication. This would be an estimate, but it is accurate enough for the situation.

In the following problems, you will learn how several health care workers use measurements. You will be asked to find the exact answer to the problems and sometimes to estimate the answer, too. Then, you may decide whether the estimated answer or the exact answer would be better for the health care worker to use.

Problems

1. **Dr. Jeffreys is a dentist.** She takes care of people's teeth by making sure they are kept clean and healthy, by filling cavities, and by treating disease of the gums and teeth.

When Dr. Jeffreys drills a tooth to fill a cavity, she must drill a hole at least 2 mm deep. If she drills as far as 4 mm, though, she will enter the pulp and destroy the root.

a. Dr. Jeffreys has drilled 1.48 mm deep in a cavity. Round off to the nearest tenth of a millimeter. About how much farther should Dr. Jeffreys drill to reach 2 mm?

b. Exactly how much more should Dr. Jeffreys drill to reach 2 mm?

c. Do you think Dr. Jeffreys should use the exact or estimated answer? Why?

2. George Chang is a pharmacist. He works in a drug store. He fills prescriptions and answers people's questions about medications. Here is a prescription which Mr. Chang is going to fill.

K. L. Wohlheit, M. D.
660 Center Street
Centerville, MO

Name: J. R. Patient

Address: Date:

℞

Tetracycline
250 mg caps. sig. 1 by mouth
4 X daily
Sufficient for 10 days

K. L. Wohlheit

a. The prescription states that the patient needs 4 capsules of tetracycline every day, for 10 days. How many capsules in all will he need?

b. The medication in each capsule weighs 250 mg. How much will the medication for all 10 days weigh?

c. Would Mr. Chang estimate or get an exact answer to these questions?

---

3. Sara Wilder is a medical illustrator. She draws pictures for medical textbooks and journals. Sometimes she also makes models from clay or other materials.

   Sara is drawing a picture of a skeleton. The real skeleton is 68 inches tall. Sara knows that the distance from the top of the head to the hipbone is about 2/5 of the total height.

   a. What is 2/5 of 68 inches?

   b. Round off to the nearest inch to determine the approximate distance from the top of the head to the hipbone.

   c. The skeleton Sara has drawn is 21 cm tall. When Sara checks her drawing, the distance from the top of the head to the hipbone should be about how many centimeters?

   d. Do you think Sara would use exact or estimate measures in making her drawings?

4. Jim Brownlee is the cashier in the admissions office of City Hospital. Jim is in charge of the bills which patients must pay when they have been in the hospital.

   Mr. and Mrs. Carey have just had a new baby girl. Mrs. Carey has been in the hospital for 3 days. When she is ready to go home, Mr. Carey goes to the cashier. Jim Brownlee is working on the bill, which looks like this.

Delivery Room	$ 80.00
Anesthesia	150.00
Room Charges	270.00
Nursery Charges	120.50
Laboratory	50.00
Medication	30.85

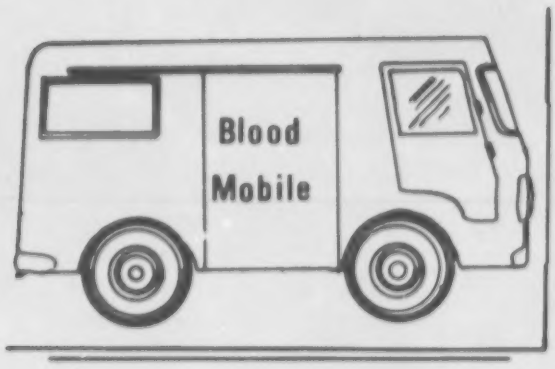
   a. Round off each item to the nearest dollar, and estimate the bill.

   b. Add up the bill exactly.

   c. Would Jim use the exact or estimated answer?

   _____

5. Claire Longbow is a blood bank technologist (also called a phlebotomist).



The blood bank takes blood from donors and then stores it until someone needs the blood. Some days, Claire travels around in a special van called a bloodmobile. She goes to different centers where people come to give blood.

a. One morning 38 people gave blood at the bloodmobile. Each one gave 500 ml. How much blood was donated that morning?

_____ ml

_____ l

b. That evening, a friend asked Claire about how much blood was donated that morning. Claire rounded off the number of donors to the nearest 10. Then she told her friend the approximate number of liters donated. What did she say?

STUDENT ACTIVITY MATERIAL

ANSWER KEY

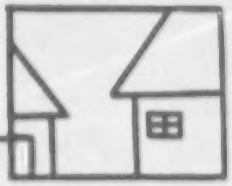
1. a. .5 mm
   b. .52 mm
   c. Dr. Jeffreys would probably use an exact measurement, although an estimated measurement will be accepted if the student had supported the answer with a good reason.

2. a. 40 capsules
   b. 10,000 mg or 10 g
   c. exact measurements

3. a. 27 1/5 inches
   b. 27 inches
   c. 8 2/5 cm (or 8 cm estimated)
   d. estimated measurements

4. a. $703.00
   b. $702.10
   c. exact

5. a. 19 liters
   b. 20 liters



HOME and COMMUNITY

Students will measure the width and length of a table top at home, using a ruler marked in inches. They will round off the measurements to the nearest inch and find the best approximation of the perimeter. Students will repeat the exercise using centimeters.

EVALUATION

1. Decide whether the following health workers might need an exact measurement, or whether an estimated measurement might do. Put a check by your answer.

	Exact	Estimated
a. A doctor telling an overweight man how many pounds he should lose.		
b. A nurse measuring medication for a shot.		
c. A medical science writer who is writing a story about what makes a good diet. The story will be in a news magazine.		
d. A hospital food service administrator who is planning food purchases for the next week.		
e. An X-ray technician taking an X-ray.		

2. A doctor is taking care of a sick child who is in the hospital. The child has had a high temperature for two days. The doctor decides to use a new medicine to bring down the fever.

EVALUATION

He asks the nurse to check the child's temperature regularly after the medicine is given. She records the temperature on the child's chart.

1:10 p. m.	104.8° F
1:40	104.3°
2:30	103.1°
4:00	101.9°
5:05	101.1°

a. Exactly how much did the temperature go down?

b. Rounding off to the nearest degree, how much did the temperature go down?

c. Rounding off to the nearest hour and to the nearest degree, how long did it take for the temperature to go down three degrees?

EVALUATION

ANSWER KEY

1. a. estimated
   b. exact
   c. estimated
   d. estimated
   e. exact

2. a. 3.7^{o}
   b. 4^{o}
   c. 3 hours

Component 3

Section One

Section Two

Section Three

UNDERSTANDING AND PLANNING OUR ENVIRONMENT

Introduction

This component offers the student the opportunity to explore careers in the Environment Cluster while understanding how math skills are useful in these occupations. The first section presents problems in addition and subtraction of simple equalities and inequalities in a sample situation. In the second section, the student will estimate the value of resources as well as man's impact on the environment. In the third section, environmental problems are solved through the multiplication and division of whole numbers less than 1000.

GOALS

MOTIVATION : The student will solve simple equalities and inequalities using addition and subtraction in a simple situation in the environment.

LIFE SKILLS: The student will estimate the value of resources and man's impact on the environment.

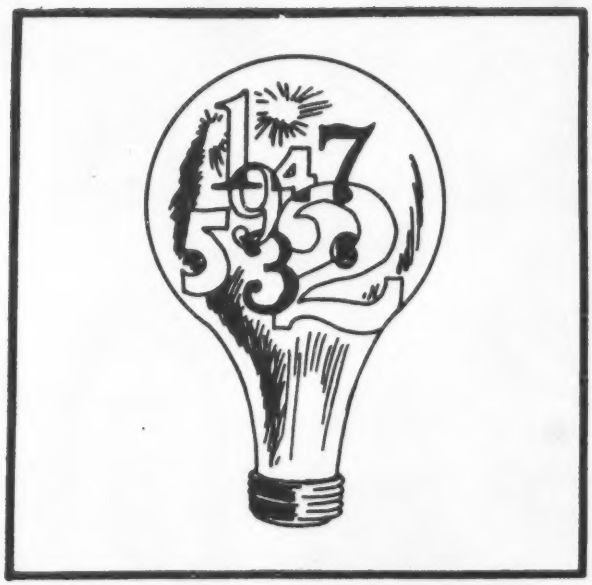
MATH SKILLS: The student will determine solutions to environmental problems through the multiplication and division of whole numbers less than 1000.

LEARNING SECTIONS

Section 1: City Planners

Section 2: Estimating Values and Cost

Section 3: Our Environment



COMPONENT III
Section One

Section One
City Planners

Key Words

- urban planner
- key
- code
- decode
- functional

Learning Objective

Given a situation related to the Environment Cluster and involving the use of simple equalities and inequalities, the student will complete the activity according to the criteria of the teacher.

Materials

- narrative
- maps
- worksheets

Domains and Levels

Cognitive: Knowledge, Comprehension, Application.

Affective: Receiving, Responding

IMPLEMENTATION GUIDELINES

Time: *45 Minutes*

STEP I - The teacher may briefly review simple equalities and inequalities using addition and subtraction with whole numbers less than 1000.

STEP II - Students should do this activity on an individual basis. The sample solution to decoding, however, should be done as a class exercise.

STEP III - The students may use the worksheet to solve the codes in the activity. The evaluation will consist of the worksheet with accompanying solutions.

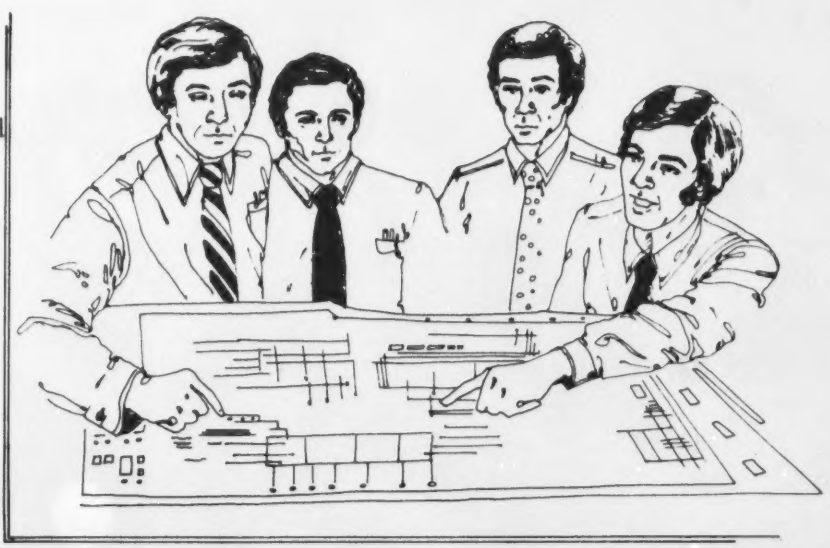
STEP IV - The Home and Community section is optional, to be assigned if time permits.

STUDENT ACTIVITY MATERIAL

Urban Planner

Have you ever looked at a city map? What did you see on the map? Most of the time you may see roads, parks, rivers, lakes and business areas. You may even see schools, hospitals, and colleges on the map.

Have you wondered who decides or plans where everything is to be built in a city? Many people help make these decisions. One person who plans cities for the future is an urban planner.



Urban planners are people who help develop plans to improve cities and towns as they grow. They need to know about transportation, recreation, housing, business, and health and educational needs in a city. Planners must know how all of these parts fit together so that the city will be functional for the people who live there.

Many urban planners use math codes on their city planning maps. They use codes for several reasons. The main reason is that they don't want other city planners to know what they have done. The plans are kept secret until the ideas can be sold to the city manager.

Today you will have a chance to use a math code. The code will allow you to find out how one urban planner has decided to build a new town. The town is Stellar City. The town is very small now, but it will grow in the future.

To decode the map of Stellar City, look at this decoding example:

On the map is the code: 17 + 31 — 25

This the way you solve the code

Step 1: Add or subtract the first two numbers in the code depending on **the sign between the numbers.**

Example: code 17 + 31 - 25

Add: 17 + 31 = 48

Step 2: Take the answer in Step 1 and add or subtract $\underline{x}$ depending on the sign before the last number. Set this equal to the last number of the code and solve for $\underline{x}$.

Example: $48 - x = 25$

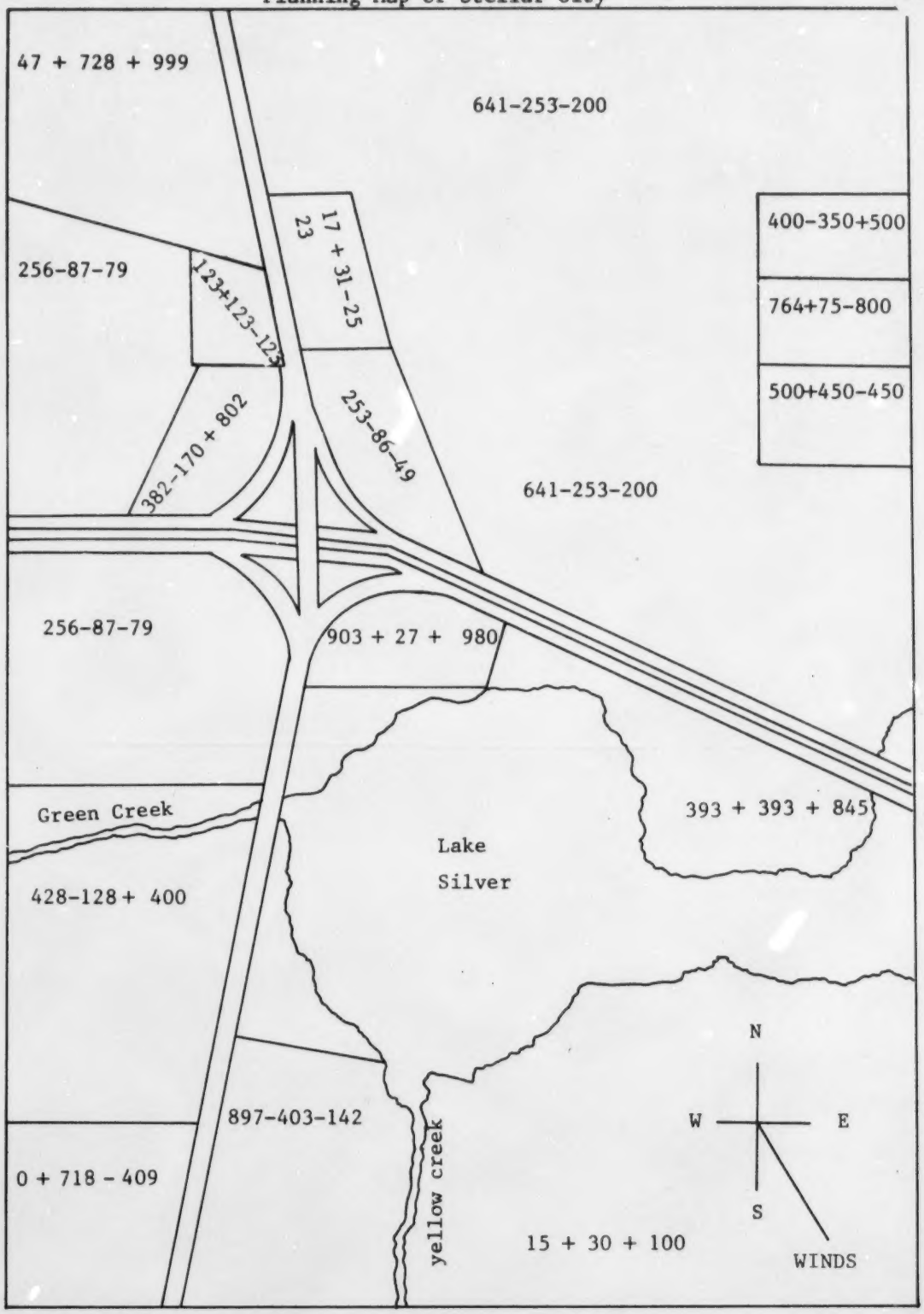
$x = 23$

Step 3: take the value of $\underline{x}$, in this example $x = 23$, and compare the number to the Code Key to Stellar City

Example: $x = 23$; 23 is a church on the code key.

To make your decoding easier do your own work on the worksheet and write your answers on the Planning Map of Stellar City. What is missing on the map?

Planning Map of Stellar City 83



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Code Key to Stellar City

23 — Church

39 — Middle School

50 — Fire Department

55 — Industrial District

59 — Park

90 — Business District

98 — Police Department

100 — College

123 — Bank

188 — Residential

224 — Shopping Center

309 — Cemetery

352 — Power Plant

450 — Elementary School

500 — High School

590 — City Hall

Work Sheet

Code 17 + 31 — 25

Step 1 17 + 31 = 48

Step 2 48 — x = 25

X = 23

Step 3 23 — Church

Code _____

Step 1 _____

Step 2 _____

_____

Step 3 _____

Code _____

Step 1 _____

Step 2 _____

_____

Step 3 _____

Code _____

Step 1 _____

Step 2 _____

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Step 1 _____

Step 2 _____

Step 3 _____

Code _____

Step 1 _____

Step 2 _____

_____

Step 3 _____

Answers

Code 17 + 31 — 25

Step 1 17 + 31 = 48

Step 2 48 — X = 25

X = 23

Step 3 23 — Church

Code 764 + 75 — 800

Step 1 764 + 75 = 839

Step 2 839 — X = 800

X = 39

Step 3 39 — Middle School

Code 903 + 27 + 980

Step 1 903 + 27 = 930

Step 2 930 + X = 980

X = 50

Step 3 50 — Fire Department

Code 15 + 30 + 100

Step 1 15 + 30 = 45

Step 2 45 + X = 100

X = 55

Step 3 55 — Industrial District

Code 393 + 393 + 845

Step 1 393 + 393 = 786

Step 2 786 + X = 845

X = 59

Step 3 59 — Park

117

Code 256 — 87 — 79

Step 1 256 — 87 = 169

Step 2 169 — X = 845

X = 90

Step 3 90 — Business District

Code 235 — 86 — 49

Step 1 235 — 86 = 147

Step 2 147 — X = 49

X = 98

Step 3 98 — Police Department

Code 428 — 128 + 400

Step 1 428 — 128 = 300

Step 2 300 + X = 400

X = 100

Step 3 100 — College

Code 123 + 123 — 123

Step 1 123 + 123 = 246

Step 2 246 — X = 123

X = 123

Step 3 123 — Bank

Code 641 — 253 — 200

Step 1 641 —253 = 338

Step 2 388 — X = 200

X = 188

Step 3 188 - Residential

Code 47 + 728 + 999

Step 1 47 + 728 = 775

Step 2 775 + X = 999

X = 24

Step 3 224 — Shopping Center

Code 0 + 718 — 409

Step 1 0 + 718 = 718

Step 2 718 — X = 409

X = 309

Step 3 309 — Cemetery

Code 897 — 403 — 142

Step 1 897 — 403 = 494

Step 2 494 — X = 142

X = 352

Step 3 352 — Power Plant

Code 400 — 350 + 500

Step 1 400 — 350 = 50

Step 2 50 + X = 500

X = 450

Step 3 450 — Elementary School

Code 500 + 450 — 450

Step 1 500 + 450 = 950

Step 2 950 — X = 450

X = 500

Step 3 500 — High School

Code 382 — 170 + 802

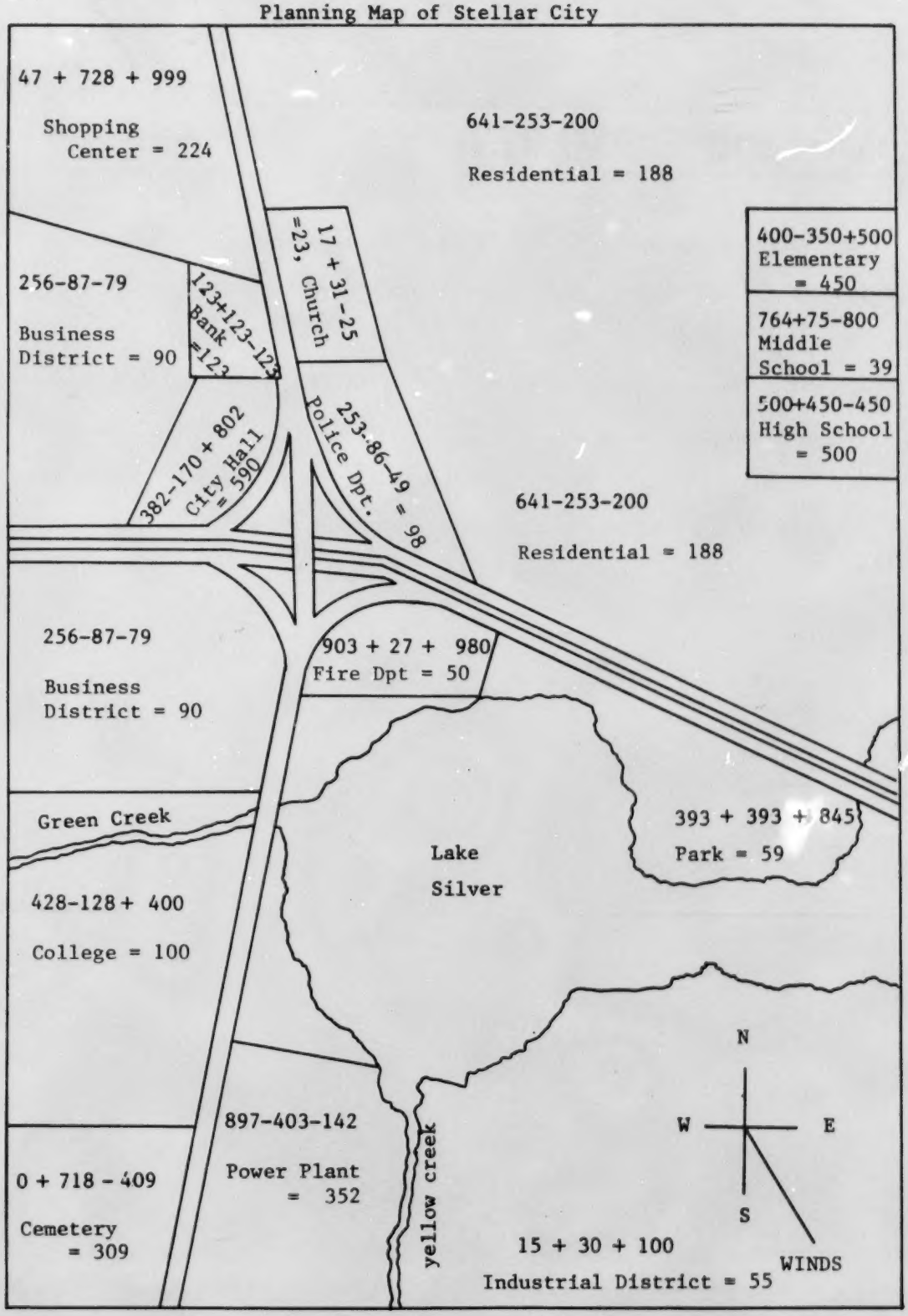
Step 1 382 — 170 = 212

Step 2 212 + X = 802

X = 590

Step 3 590 — City Hall

Planning Map of Stellar City



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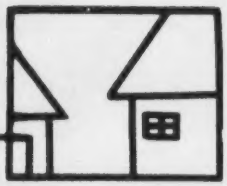

HOME and COMMUNITY

The students, together with family members, may examine a city map. Operations that involve the use of equalities and inequalities on a city map are:

(1) Using the map legend, find how far it is from your home to school, downtown or a park.

(2) Not all block numbers are given on a city map. Find two block numbers on the same street and decide what the block numbers are for each street in between the two block numbers.

EVALUATION

Because of the nature of this component, the completion of the worksheet constitutes the evaluation.

COMPONENT III
Section Two

Section Two

Estimating Values and Cost

Key Words

- estimating
- value
- resource
- environment

Learning Objective

Given short narratives about the use of resources and their related cost to the environment, the student will be able to estimate the value or cost of man's presence in the environment with 70% accuracy.

Materials

- narratives
- problems
- evaluation

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Domains and Levels

Cognitive : Knowledge, Comprehension, Application, Analysis

Affective : Receiving, Responding, Valuing

IMPLEMENTATION GUIDELINES

Time: *45 Minutes*

STEP I - The student should have the ability to round whole numbers to a given position (10 100 1000 1,000,000). The teacher should briefly discuss approximations (estimates) with the class.

STEP II - This component is designed for an individual activity, but students may be assigned in groups to solve problems. Some of the problems may require the solution to a prior problem. Students should be made aware of this fact to help them solve the problems.

STEP III - The narratives may be read individually or orally and discussed to bring out important facts.

STEP IV - Each student should complete the evaluation individually.

STEP V - The Home and Community activity is optional, to be assigned if time permits.

STUDENT ACTIVITY MATERIAL

Estimating Values and Cost

The Value of a Forest

Foresters take care of forest lands in our environment. They help to manage these forests and land for their resource value. The nation needs the trees for building homes, making furniture, and manufacturing paper products. If it were not for the forester, the paper you use in class would cost more every year. These people usually work in national forests, but they also help landowners take care of private forests. Many businesses hire foresters to work for them. Logging, lumbering and paper companies need the use of foresters to stay in business.

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John Sullivan has worked for the National Park Service for eight years. When he began, he was a fire lookout. Today, John works in an office most of the time. His job is to estimate the number of trees in national forests and find out how many trees can be cut each year without hurting the forest. The trees that will be cut will be sold to private companies. John needs to estimate the value of trees. The money the government gets from private companies for its trees is used to plant new trees, fight forest fires, and protect trees from insects and disease. John also has to estimate how many trees can be saved each year by using the money from the sale of timber.

Today you will help John estimate the timber in the David Crockett National Forest in East Texas. John knows that the forest has 161,478 acres of trees. He wants to sell all of the large pine trees in only 569 acres. Each acre has about 10 large pine trees and each tree is worth about $319.00 dollars.

Worksheet

1) Estimate how many large pine trees are in the David Crockett National Forest to the nearest 1000 trees.

2) Estimate the value of all trees in the national forest to the nearest $1,000.

3) Estimate how many trees John will be able to sell from the 569 acres to the nearest 10 trees.

4) About how much money will the government receive from the sale of 5500 trees to the nearest $100?

5) For every tree that is cut down in the forest, four small trees must be planted. About how many small trees must be planted to the nearest 1000 trees?

6) If each replanted tree cost $ 39 to plant, estimate the cost of replanting the forest to the nearest $10.

7) About how much money will be left after the forest is replanted to improve the forest to the nearest $100,000?

8) If 68% of the trees planted will die in 10 years due to insects, fires or disease, how many trees planted will live to the nearest 10% of trees?

9) To the nearest 1000 trees, how many more trees will be in the forest after 10 years than before the trees were cut?

Answers

1) 161,000 acres

x 10 trees per acre
1,610,000 trees in the National forest to the nearest 1,000

2) 1,288,000 trees in forest

x 300 cost per tree
386,400,000 value of trees nearest 100,000

3) 570 acres to be sold

x 10 trees per 1 acre
5,700 trees to be sold

4) 5700 trees to be sold

x 300 cost of 1 tree
$1,710,000 money received

5) 6,000 trees cut down

x 4 trees replaced
24,000 trees to be planted

6) 24,000 trees to be replanted

x 40 cost of 1 tree
960,000 cost to replant forest

7) $1,700,000 money received from sale

−1,000,000 cost to replant

7,00,000 left for improvement to forest

8) 100% all trees planted

—70% trees that die
30% trees that live

24,000 trees planted

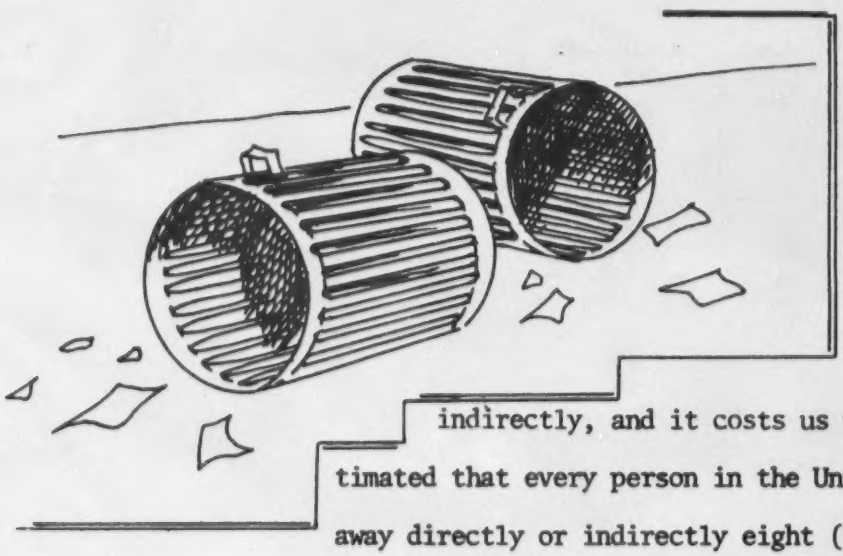
x .30 % trees will live
7200.00 trees will live

9) 7,000 trees after 10 years

—6,000 trees cut down
1,000 trees more in the forest after 10 years

Estimating the Cost of Our Garbage

Every day you throw something away into the environment. It may be a piece of paper or the food left from your lunch. If you buy a dress or a new baseball bat you had to pay something for the garbage the factory made when it produced the item you bought. We make garbage directly and indirectly, and it costs us money. It has been estimated that every person in the United States throws away directly or indirectly eight (8) pounds of garbage every day. Each 10,000 pounds of garbage costs about $692.00 to each of us every year.



1. To the nearest 1000 pounds, how many pounds of garbage do you produce each year?

2. About how much does your garbage cost you each year to the nearest $10 per year?

3. About how many pounds of garbage does your family make each year to the nearest 1,000 pounds?

4. Estimate the number of people in your class to the nearest 10 persons. About how many pounds of garbage does your class make each day? Each year?

5. About how much money does garbage cost your class each year to the nearest 10,000?

6. If there are 214,964,302 people in the United States, how many pounds of garbage are made each day in the U. S. to the nearest 10 million persons?

7. To the nearest dime, how much does it cost per day per person to get rid of garbage?

8. To the nearest hundred million people, how much does it cost all of the people in the U. S. to pay for garbage each day?

Answers

1) 365 days in 1 year

x 8 pounds per day

2920 pounds per year = 3,000 pounds per year per person.

2) 3,000 pounds 1 year per person = X dollars / year / person

12,000 pounds per 1 year 690 dollars = 1 year

$$X = \frac{690 \times 3,000}{12,000}$$

X = $170 year/person

3) Answer will vary depending on family size. Example assumes an average family of four persons.

3,000 pound / year / person

x 4 person / family

= 12,000 pounds / family / year

4) Answers will vary depending on class size. Example aasumes 30 students/ class.

Day	Year
30 students	240 pounds / day / class
x8 pounds per 1 day	x 365 days in 1 year
240 pounds per 1 day per 1 class	1200 1440 720 87600 pound / year / class

5) Answers will vary depending on class size used in problem 4.

$$\frac{90{,}000 \text{ pound / year / class}}{10{,}000 \text{ pound / year}} = \frac{X \text{ dollar / year}}{700 \text{ dollar / year}}$$

$$X = \frac{700 \times 90{,}000}{10{,}000}$$

$$= \$63{,}000 \text{ cost / year / class}$$

6) 210,000,000 persons in the U.S.
x 8 pounds / person / day
1,680,000,000

7) $170 dollars / year / person — 365 days in 1 year = $.50 a day per person.

8) 200,000,000 people in U.S.
x .50 dollar/day/person
$10,000,000,000 dollars 1 day in U.S.

HOME and COMMUNITY

The student may work with family members to estimate the amount of garbage thrown away each year. One method is to measure the weight of the garbage for one week and then estimate the yearly output from this measurement.

Students may also make some money in the neighborhood by collecting aluminum cans. The student can weigh the cans collected and estimate the money they will receive when the cans are turned in for recycling.

The worksheet may be used by the student to do these estimates.

EVALUATION

1) How does a forester use estimates on the job?

_____

2) How can estimates show how garbage costs you money?

_____

3) Are estimates exactly correct or about correct? Why is this true?

_____

_____

4) If one acre of land has about 243 trees, how many trees are on 189 acres to the nearest 10?

_____

5) If each acre of trees is worth about $21,342 and each acre has 978 trees, estimate the value of one tree to the nearest $1,000.

6) If Juan's family produce 621 pounds of garbage, Silvia's family produces 479 pounds of garbage and Rachel's family produces 845 pounds of garbage in one month, how many pounds to the nearest 100 pounds do these families produce each month together?

7) Why do people use money in understanding how resources are used in our environment?

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EVALUATION

Answers

1) Foresters use estimates to determine the number of trees per acre, cost of trees, and the replacement and care of trees. Accept any logical answers.

2) Estimates show about how much garbage each of us produces and the cost of the garbage to each of us. Accept all logical answers.

3) Estimates are "about correct" because the number used in the estimate are rounded and not exact.

4) 240 trees per 1 acre

190 acres

21,600

240

45,600 estimated number of trees.

5) $21,000 per acre ÷ 1,000 trees per 1 acre = $21/ tree.

6) 600 + 500 + 800 = 1900 pounds / 3 families

7) Money is a common denominator which allows the cost of goods and resources to be compared to one another. Accept all logical answers.

COMPONENT III
Section Three

Section Three

Our Environment

Learning Objective

Given situations involving the jobs of persons in the Environment Cluster, the student will solve, with 80% accuracy, related quantitative problems using multiplication and division, using any whole number less than 1,000.

Key Words

- environment
- quantitative
- analysis
- monitor
- fumigator
- analyst

Domains and Levels

Cognitive: Knowledge, Comprehension, Application

Affective: Receiving, Responding

Materials

- copies of activity
- evaluation

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IMPLEMENTATION GUIDELINES

Time: *45 Minutes*

STEP I - The teacher should briefly state the purpose of this component. The purpose is to allow the student to see how individuals who work in the environment use multiplication and division on the job.

STEP II - The introduction should be read and discussed and key words reviewed. All students should be able to multiply and divide whole numbers less than 1,000.

STEP III - Students should work individually to solve each problem. The teacher will act as a resource person in the event of individual problems.

STEP IV - The evaluation is to be completed on an individual basis.

STEP V - The Home and Community section is optional, to be completed if time permits.

STUDENT ACTIVITY MATERIAL

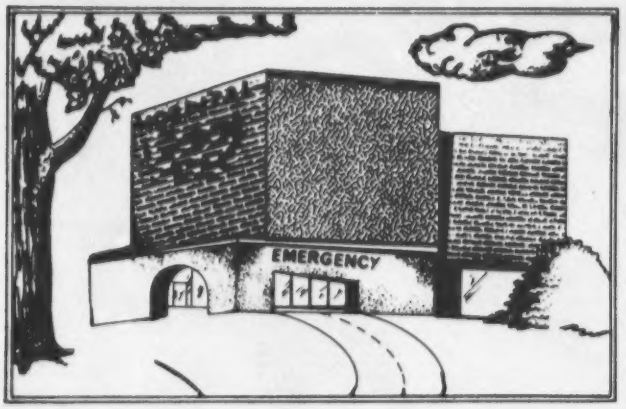
Our Environment

When you think about the environment, do you see water, land, air, animals or plants? Maybe you do and maybe you don't. One thing that you may not think of is multiplication and division. People who work in the environment often use math to solve problems. They do this to understand the changes in the world, today and in the past, or possibly the future.

If it were not for quantitative analysis, using numbers to measure things in the world around us would be difficult to understand. Many people use quantitative analysis in their jobs.

Today you will use multiplying and dividing to solve problems, like the people that work in the study of our environment do. Each short story will explain a career in the environment and you will have the fun of helping solve the problem using your math skills. Get ready; here we go!

Problems



Linda Mitchell is a radiation monitor at a large city hospital that treats cancer patients with radiation. She checks the amount of radiation that the nurses who work with radiation receive each year. A nurse that works with radiation cannot receive more than 192 REMs of radiation in one year or they may get radiation sickness. A REM is a measure of radiation. A nurse may work only 60 days in the radiation room in one year.

1. If a nurse works in the radiation room for 57 days and receives 3 REMs of radiation each day, how many REMs of radiation will she receive? Will she get sick?

2. What is the most days a nurse can work in the radiation room if they receive 3 REMs of radiation each day?

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3. Using your answer in number 2, why do you think the radiation monitor only allows nurses to work 60 days with the radiation?

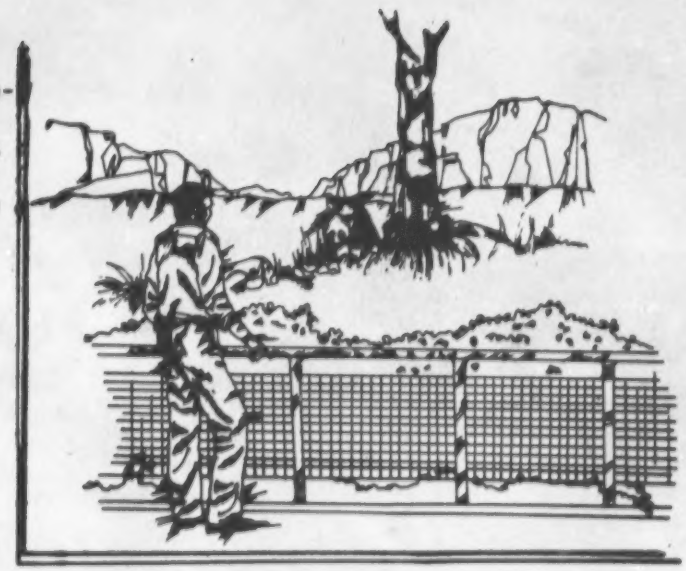
Orchard fumigators kill insects and pests on fruit trees by spraying them with a poisonous gas. Some trees need 12 cubic feet of gas to kill the insects. Larry Todd, a fumigator, is concerned about the poisonous gas killing birds. He does not want to use more gas than is needed on a field of fruit trees. Larry knows that the gas he uses may kill birds and animals. He always measures the amount of gas he uses, to see if he used only what was required.

4. Larry wants to know how many cubic feet of gas he will need to fumigate 76 peach trees. How many cubic feet of gas will Larry need?

5. Larry used 988 cubic feet of gas when he was finished with the orchard. How many cubic feet of gas did he use on each of the 76 trees? _____ Did Larry use too much gas on each tree or not enough gas? _____

6. How many cubic feet of gas will Larry use in an orchard that has 437 trees, if each tree needs 68 cubic feet of poison gas?

Franco Estrada is the game keeper in a National Wildlife Preserve. He has to protect animals and birds that live in there. He needs to keep up with how many animals can live in the preserve. If too many animals are in the park, many may starve because all the natural food is eaten.



7. In one section of the preserve there are 722 acres of land, and it takes 23 acres to feed one deer. How many deer can live in this section?

8. If Franco has done his job well there is one deer for every 23 acres in the preserve. There are 907 deer in the preserve by his count. How many total acres are in the preserve?

Amber Utley works for the Environmental Protection Agency (EPA). She is an air analyst. Her job requires that she take samples of dust that is given off by smoke stacks in factories. Amber follows standards which tell her when a factory is polluting and when it is not polluting the air.

The EPA has set many standards for pollution. The amount of dust that a coal-burning power plant makes each month is limited to 95 tons of dust.

9. If 95 tons of dust are allowed each month, how many tons are allowed for one year?

10. If there were 31 days in the month of December and 93 tons of dust were made on a power plant, how many tons were made each day in December?

Answers

1) 57 x 3 = 171 REMS

2) 192 ÷ 3 = 64 days

3) The 4 day extra is a safety margin for radiation contact. Accept all logical answers.

4) 76 x 12 = 912 cu. ft. gas

5) 988 ÷ 76 = 13 cu. ft.
Larry used 1 cu. ft. too much on each tree.

6) 437 x 68 = 29,716 cu. ft.

7) 722 ÷ 23 = 34 deer

8) 907 x 23 = 20,861 acres

9) 95 x 12 = 1,140 tons in 1 year.

10) 93 ÷ 31 = 3 tons per 1 day

HOME and COMMUNITY

Students may work with family members using multiplication and division to find out about their home environment.

Ask a family member the following questions:

(1) How many gallons of gasoline do you use each week? _____

(2) How many miles do you travel each week? _____

(3) How does the use of a car affect the environment? _____

_____

Using this information find out:

(1) How many miles per gallon does the car get each week? _____

(2) How many gallons of gasoline are used one year? _____

(3) How many miles does the car travel in one year? _____

EVALUATION

EVALUATION

1) Name three jobs that work with the environment

   a. _____

   b. _____

   c. _____

2) If 163 trees need to be sprayed for bugs and 16 gallons of spray are needed for each tree, how many gallons of spray will be used on the trees?_____

3) If a factory makes 611 tons of dust in 47 days, how many tons did it make each day? _____

4) In a wildlife park there are 528 raccoons. If it takes 38 acres of land to feed one raccoon, how many acres have to be in the park?

_____

5) A cancer patient has received 96 REMS of radiation in one year, how many REMS did he receive in each month?

_____

EVALUATION

Answers

1) orchard fumigator

   air analyst

   gamekeeper

   radiation monitor

2) 163 x 16 = 2608 gallons

3) 611 ÷ 47 = 13 tons per 1 day

4) 528 x 38 = 15,064 acres

5) 96 ÷ 12 = 8 REMS per month